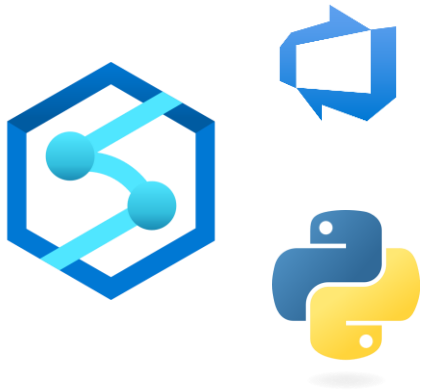
Motion10
Maak(t) uw digitale innovatie succesvol

CICD Synapse Serverless

Incremental deployments with Python and Pandas



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We couldn't do it without you.

DATA RELAY

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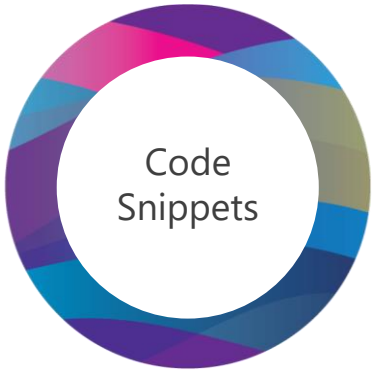
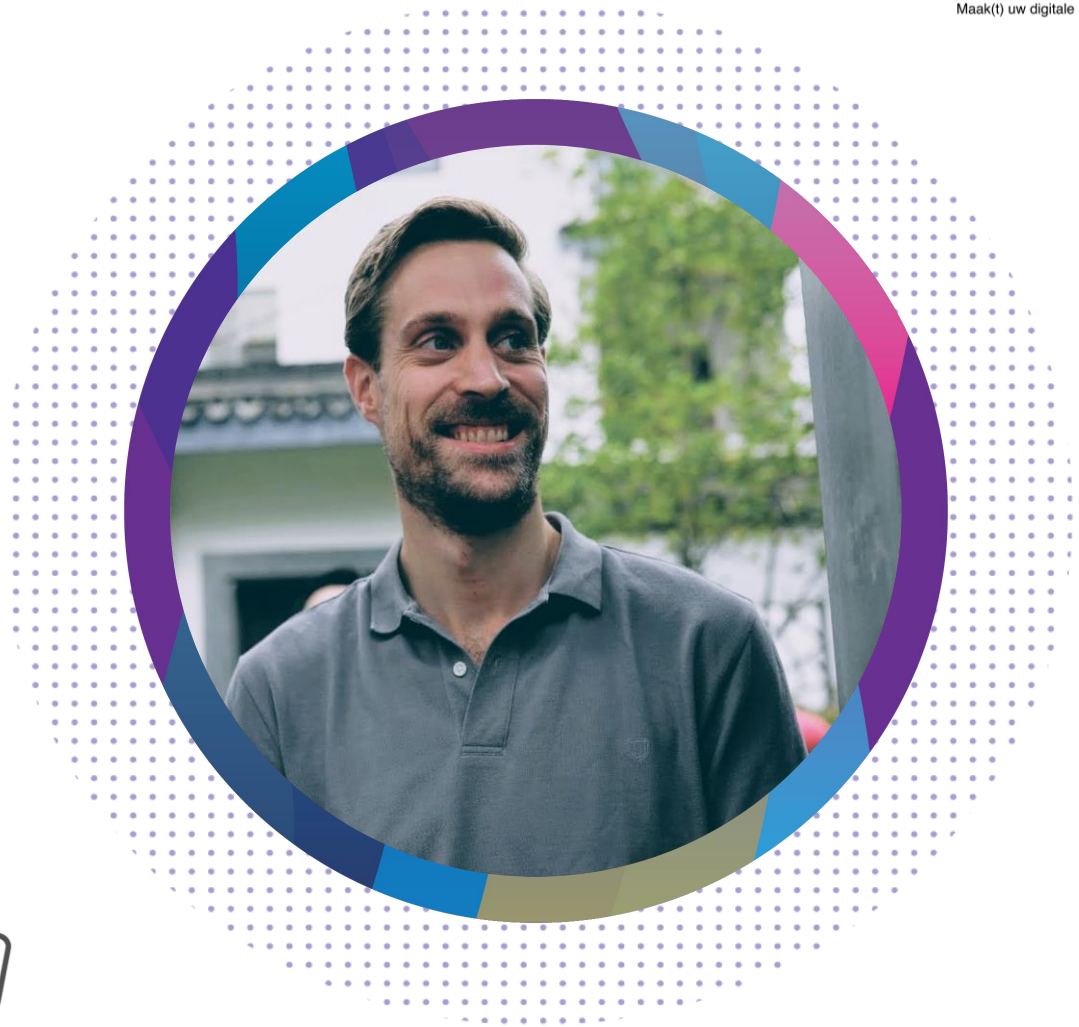


Introductions



Arthur Steijn

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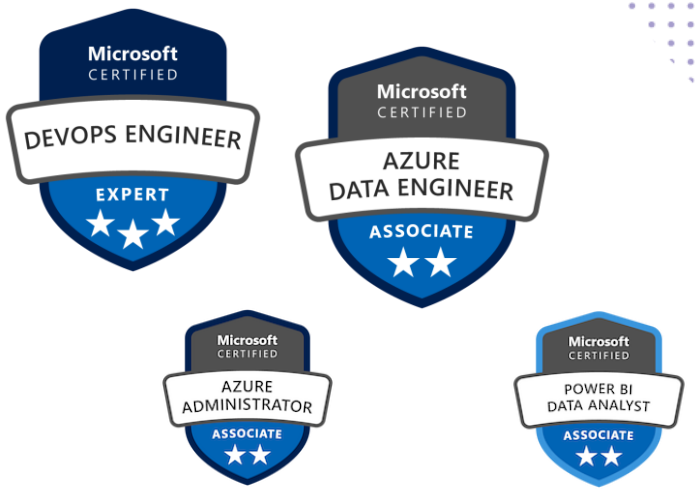
(Rotterdam, the Netherlands)

- Started with SSRS somewhere 2014
- Data, Cloud & DevOps Engineer
- Main focus on DevOps for 'BI'

- Father of two
- CrossFit

Blog: **sidequests.blog**



General assumptions of (some) knowledge on

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General DevOps practices like

- Source Control
- CICD; Continuous Integration, Continuous Deployment

Azure DevOps as a tool for;

- Azure Repos
- Azure Pipelines

Azure Synapse Analytics;

- Source Control for the Synapse Workspace
- Serverless SQL Pool

Sounds nice, but why Serverless SQL Pools

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- Basic discovery and exploration

- The Logical Data Warehouse (LDW)

- Data Transformation

Sounds nice, but why Serverless SQL Pools

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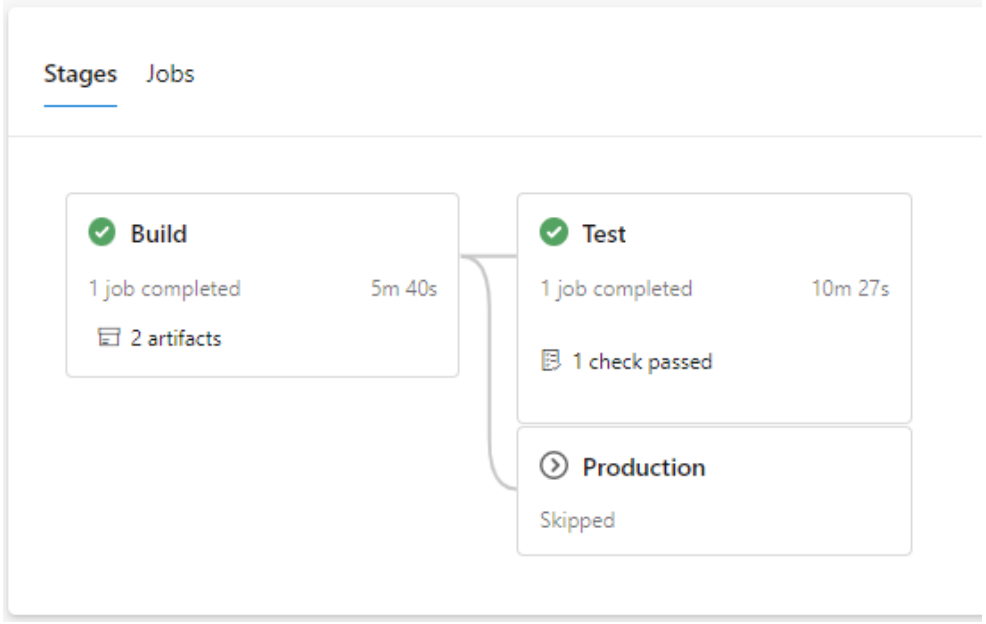
- The Logical Data Warehouse (LDW)
  - Separation of storage and compute!
  - Less ETL, hence it is used directly on the Data Lake
  - Works with familiar tools like;
    - SQL Server Management Studio
    - Azure Data Studio
    - Power BI connects like any other SQL source
  - T-SQL Support
    - Databases
    - Schemas
    - Views
    - Logins and Users

Can you guess what comes next?

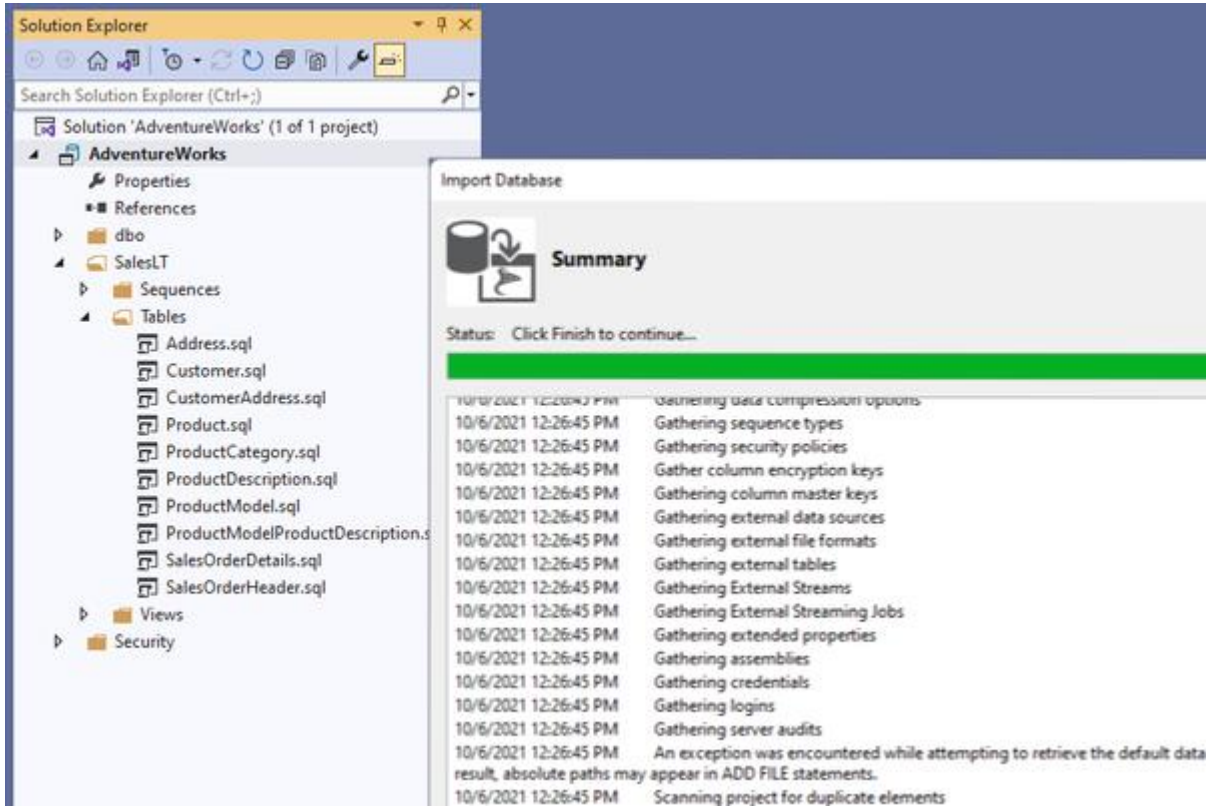
- Separate Environments

- Meaning Source Control and automated Deployments



Why and How

- Familiar with Visual Studio SQL Server Database Projects?
- We need a custom solution for source control and deployment
- What about the Synapse Workspace for source control?
- But why do you need Incremental Deployments for Serverless SQL? **



**If you think you do, think again at the end of this session;)

What makes this even more problematic

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- Dependencies on other SQL objects like
  - External tables, views, functions, stored procedures

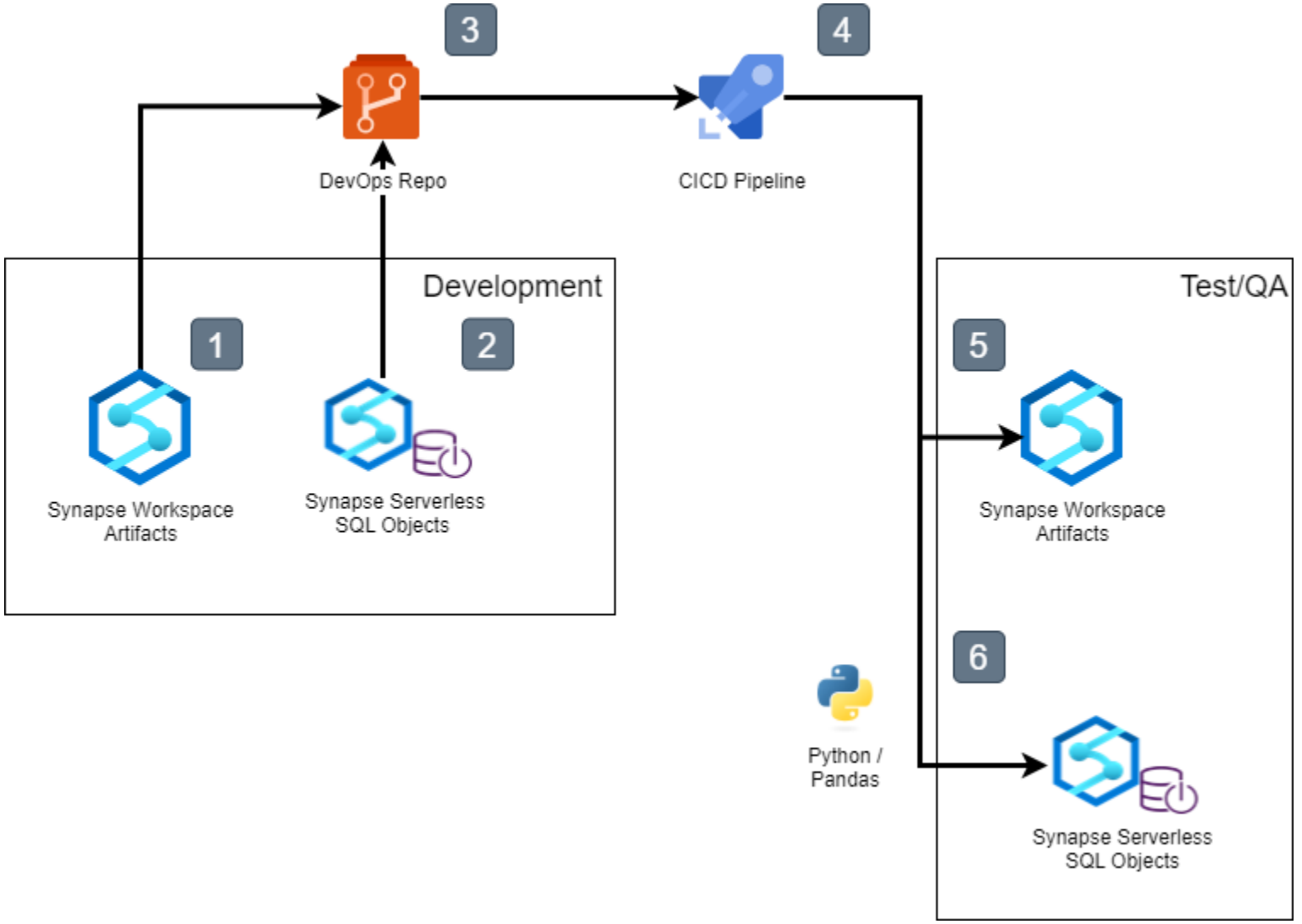
- Dependencies on files in the data lake

  data lake files
  - specific data lake folder paths that change over time

```
SELECT * FROM OPENROWSET(
BULK '/folder/yyyy/MM//dd/*-FULL.parquet',
DATA_SOURCE='storage', --> Root URL is in LOCATION of DATA SOURCE
FORMAT = 'PARQUET') AS [file]
```

- Environment specific references

High Level Architecture - Synapse Deployment

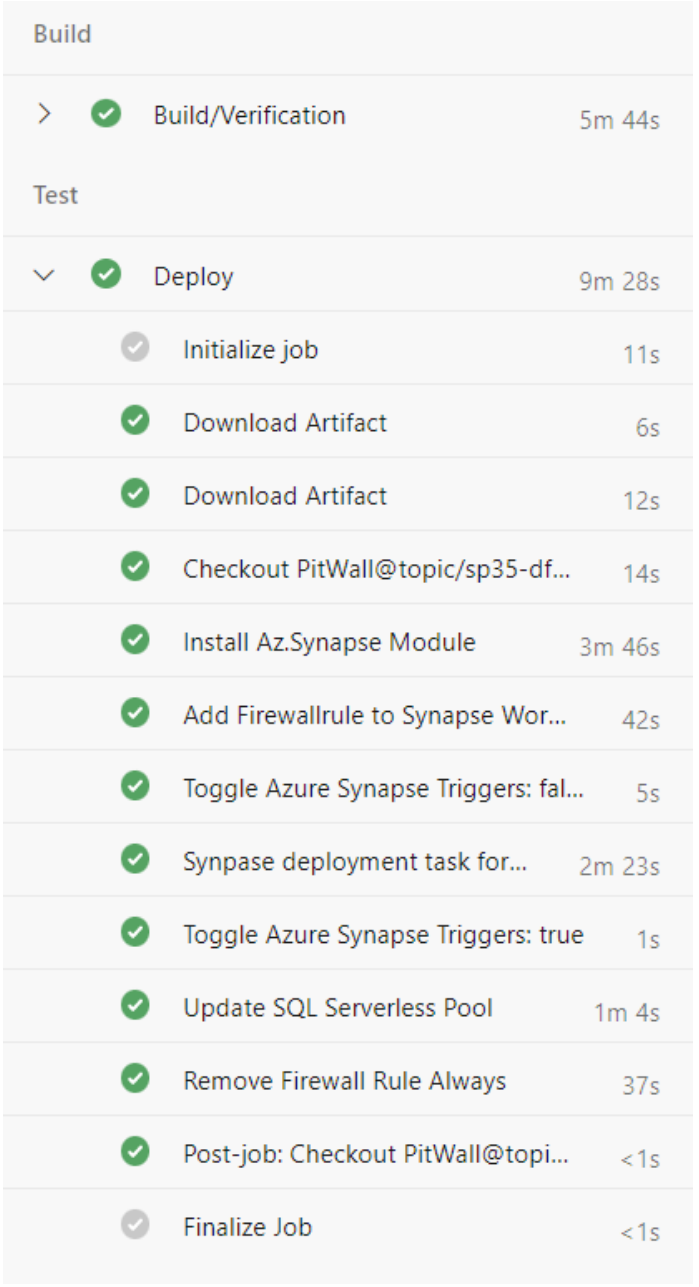


Complete Synapse Pipeline Overview

- Build stage to create needed artifacts and Validation of Synapse workspace object

Task name: *AzureSynapseWorkspace.synapsecicd-deploy.synapse-deploy.Synapse workspace deployment@2*

- Deploy stage steps:
  - Check out the artifacts and repo
  - Install Az.Synapse PowerShell module
  - Add (and remove) a firewall rule for the DevOps Agent
  - Toggle the Triggers off and on again
  - Update the Serverless SQL Pool



Source Control Options

The Synapse Workspace UI SQL Scripts

- Good: if your ws is connected to a repo, you can save directly to your working branch

- Bad: sql scripts are deployed with the Synapse Workspace Deplotment task, but not executed on the Serverless SQL Pool, this is confusing for some
- Bad: the more scripts you have the longer your workspace deployment will take (!!!)
- Bad: SQL Scripts are stored as JSON files and not easily readable in the repository

Directly in Git via Visual Studio Code (or with a similar tool)

- Good: you can save files as .sql and read them in the repo

- Bad: you need to manually add them to your repo (or write an automation script ☺ like I did)
- Bad: you still need to execute the scripts manually on the other environments (or)

Source Control for Serverless SQL Pools

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1. Initialize database script
2. .sql files for views, stored procedures, functions

- .sql files are exported with the help of a Python script
  - Create a connection with PYODBC
  - Get all databases and objects
  - Store them in your local repository folder

- Git Commit on your working branch

```python
# Run this script to export all database objects from the synapse serverless sql server
import sys
sys.path.insert(0, "scripts\syn-serverless-export\functions\functions.py")
from functions.functions import *

server = 'synapse-server-ondemand.sql.azuresynapse.net'

def main():
    """ Function to connect to an azure synapse ondemand server and exports
    all views, stored procedures and functions to .sql files for all databases """

    # get an azure ad user and repo directory
    username, output_directory = get_personal_settings()

    print('  sql server that is configured is: ' + server)
    print('  username is set to: '+ username)
    print('  output_directory is set to: '+ output_directory)

    # creata a cursor for the connection
    cursor, cnxn =  dbcnxn(server, username)

    # get all databases from the server
    databases = get_databases(cursor)

    # for each database export to sql files
    for database in databases:
        # clean export directory so that deleted objects are removed
        clean_dir(output_directory+'/'+database)
        # export all views, functions and stored procedures
        export_views_to_dotsql(cursor, output_directory, database)
        export_sp_to_dotsql(cursor, output_directory, database)
        export_fn_to_dotsql(cursor, output_directory, database)

    # close connection
    cnxn.commit()
    cursor.close()

    print("All done")

if __name__ == "__main__":
    main()
```

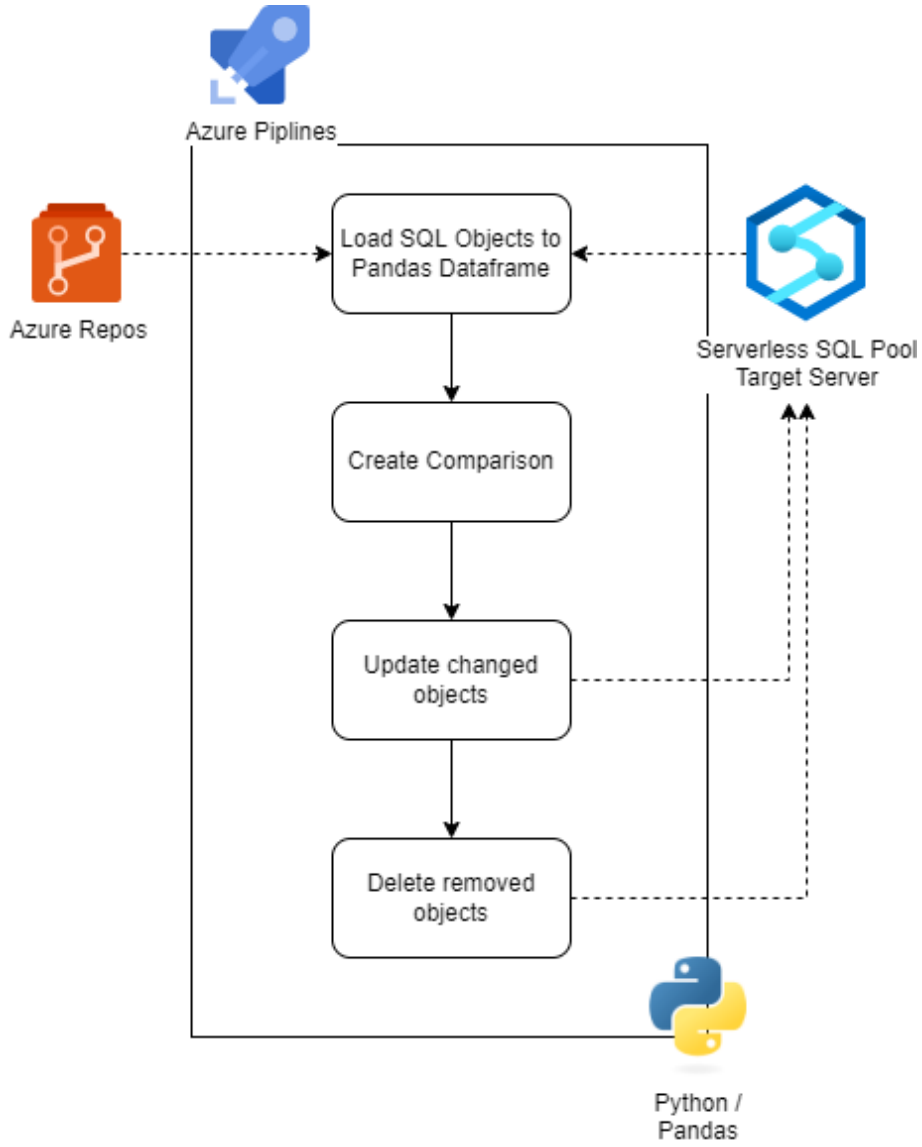
Simple manual deployment

- After database initialization
- Execute all objects from your Repository
- Optional; replace environment specific variables
- Optional; clean your sql statements (at previous source control step)
- Optional; '*Create or Alter …*'

```
# Run this script to execute all database objects on the synapse serverless sql server
import sys
sys.path.insert(0, r"scripts\syn-serverless-export\functions\functions.py")
from functions.functions import *

server = 'target-synapse-server-ondemand.sql.azuresynapse.net'

dataverse_db_name_d = 'development-server'
dataverse_db_name_p = 'production-server'

def main():
    """ Function to connect to an azure synapse ondemand server
        and execute all views, stored procedures and functions on their databases """
    #authenticate to the server with azure ad account
    username, repo_path = get_personal_settings()
    print('Creata a connection and cursor to the synapse server')
    cursor, cnxn =  dbcnxn(server, username)

    #get all the databases in the repository
    databases = os.listdir(repo_path)

    for database in databases:
        for sqlobject in os.listdir(os.path.join(repo_path, database)):
            sqlObjectFile = open(os.path.join(repo_path, database, sqlobject))
            sqlStatementString  = sqlObjectFile.read()
            print('Executing for: '+ database + '.' + sqlobject)

            # replace dataverse database reference
            if 'dp-p'in server:
                sqlStatementString = re.sub(dataverse_db_name_d, dataverse_db_name_p, sqlStatementString)

            #execute the sql statement against the server
            execute_statement(cursor, database, sqlStatementString)

    # close connection
    cnxn.commit()
    cursor.close()

if __name__ == "__main__":
    main()
```

Incremental deployment with Pandas

- Executed from an Azure DevOps agent
- All objects from the Repo are loaded into a Pandas dataframe
- All objects from the Target server are loaded into another dataframe
- The two dataframes are merged and compared on added / updated / removed objects
- The statements are executed



Create Dataframe from repository

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```
def create_df_from_repo(repo_path):
    # store all the file names in a list
    filelist = []

    for root, dirs, files in os.walk(path):
        for file in files:
        #append the file name to the list
            filelist.append(os.path.join(root,file))

    #initiate pandas dataframe from filelist
    df_repo = pd.DataFrame({'file':filelist})

    # get file contents
    for index, file in df_repo.iterrows():
        f = open(file['file'], "r")
        df_repo.at[index, 'ViewDefinition'] = f.read()
        f.close()

    # clean sql statement
    df_repo['ViewDefinition'] = df_repo['ViewDefinition'].transform(clean_sql_func_df)

    # add database name
    df_repo['DBName'] = df_repo['file'].str.replace(r'.*databasescriptsexports\\', '', regex=True, flags=re.I)
    df_repo['DBName'] = df_repo['DBName'].str.replace(r'\\.*', '', regex=True, flags=re.I)
    # add schema name
    df_repo['SchemaName'] = df_repo['file'].str.replace(r'.*databasescriptsexports\\.*\\' , '', regex=True, flags=re.I)
    df_repo['SchemaName'] = df_repo['SchemaName'].str.replace(r'\..*' , '', regex=True, flags=re.I)
    # add object name
    df_repo['ObjectName'] = df_repo['file'].str.replace(r'.*databasescriptsexports\\.*\\' , '', regex=True, flags=re.I)
    df_repo['ObjectName'] = df_repo['ObjectName'].apply(lambda st: st[st.find(".")+1:st.find(".sql")])

    df_repo['Env'] = "repo"

    df_repo = df_repo.query('DBName != “Demo-Sqldb"')

    return df_repo
```

Create dataframe from Serverless SQL Pool Object

- A lot easier than the previous step

```
def create_target_df(sql, cnxn, cursor, database, objecttype):

    cursor.execute("USE [" + database + "];")

    df = pd.read_sql(sql, cnxn)
    df['objectType'] = objecttype

    return  df
```

- Joining the two dataframes together and compare the object definition

```
df_merged = df_repo.merge(df_target, how='outer’, on=['DBName', 'SchemaName', 'ObjectName’])

df_merged['compare_sql'] = ( df_merged['ViewDefinition_x'] == df_merged['ViewDefinition_y'] )
```

Finaly; Run the solution with the Azure PowerShell task

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```
#This script is used to deploy the SQL scripts that are saved in the REPO to the SQL Serverless Database
param(
   [string][parameter(Mandatory = $true)] $ServerInstance
)

#Import needed modules
Write-Host("Importing modules")
Import-Module SQLServer
Import-Module Az.Accounts -MinimumVersion 2.2.0

#Get an access token with the Service Pricipal used in the Azure DevOps Pipeline
Write-Host("Get Access Token")
$access_token = (Get-AzAccessToken -ResourceUrl https://database.windows.net).Token

#Install Python Modules
Write-Host("Installing Python Modules")
python -m pip install pyodbc
python -m pip install pandas

#Start Python Script
Write-Host("Starting python script")
& python.exe 'scripts/database-scripts/deploy-database-changes/compare-and-deploy-database-changes.py' -
synserver $ServerInstance -access_token $access_token
if ( $LASTEXITCODE -eq 1)
{
      Write-Error "Script Execution Failed"
}
```

Debugging the Solution

- Just
- Don't
- Give
- Up

Questions?

https://datarelay.co.uk/feedback