

Azure Synapse for Actuaries

Solvency II Use Case

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Presenters:

Brent Carpenetti; Senior Actuary, Hannover Re
Hiram Fleitas; Senior Customer Engineer, Microsoft



Prior to joining Hannover Re, Brent worked as an Actuarial Analyst for Blue Cross Blue Shield of Tennessee. In this position, he lead group insured forecasting. During that time he identified cost saving initiatives and provided strategically relevant analysis on over 500,000 members that represented more than \$2,000,000,000 in premium.

At Hannover Re, Brent is responsible for deployment of innovative IT applications for effective risk mitigation through data analytics across both mortality and morbidity exposures. As an entrepreneur at heart, identifying ways to develop mutually beneficial relationships with clients is a core focus in his risk assessment and review processes.



Hiram Fleitas works on ML, Azure Synapse, Power Platform and DevOps at Microsoft as a Senior Customer Engineer in Data & AI. He wrote his first app in BASIC at 13 years old and developed a passion for computers ever since. He's built a professional career in tech over the past 25+ years while working at multiple large companies. He's spoken about ML, Azure, SQL and the Power Platform at User Groups, Code Camps, SQL Saturdays, Global AI Bootcamps and at PASS Summit.

Hiram is also a code contributor to several open source projects and serves as the IS Flotilla Staff Officer for the United States Coast Guard Auxiliary.

Brent Carpenetti

Senior Actuary, Risk Management
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<https://aka.ms/hiram>

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- **Do not** discuss what you or other entities plan to do in a particular geographic or product markets or with particular customers.
- **Do not** speak on behalf of the SOA or any of its committees unless specifically authorized to do so.
- **Do** leave a meeting where any anticompetitive pricing or market allocation discussion occurs.
- **Do** alert SOA staff and/or legal counsel to any concerning discussions
- **Do** consult with legal counsel before raising any matter or making a statement that may involve competitively sensitive information.

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What is Solvency II?

Solvency II is a risk-based capital regime, similar in concept to Basel II, implemented for European insurers on 1 January 2016. The risk-based capital requirement, the Solvency Capital Requirement (SCR), is calculated using either the standard formula; an approved internal model; or a mixture of both. The calculation is calibrated to a 99.5 per cent confidence level over a 1-year period.

What is Synapse Analytics?

Synapse is a limitless analytics service that brings together data integration, enterprise data warehousing, and big data analytics. It gives you the freedom to query data on your terms, using either serverless or dedicated resources—at scale. Azure Synapse brings these worlds together with a unified experience to ingest, explore, prepare, and serve data for immediate BI and machine learning needs.

Why?

10M+ Simulations * 100s Perspectives

- Spreadsheets cannot manage the data size.
- Database servers lack adv. statistical functions.
- R-language and library versions hinder collaboration between actuaries.

Business processes often experience delays

- Excel VBA(s) fall short of real automation.
- Actuarial code is not programmatically DRY (Don't Repeat Yourself).
- Actuaries lack collaboration with IT.

Ref: <https://support.microsoft.com/office/excel-specifications-and-limits-1672b34d-7043-467e-8e27-269d656771c3>

Why?

Legacy workflows do not drive performance

- Process owners are consumed with operations.
- Little availability to evaluate outcomes.
- Teams are unable to achieve new opportunities.

How?

Modernize intelligent R & SQL

- R is best used for model or statistics heavy workloads
- SQL is best used for data management workloads

Collaborate with Azure DevOps or GitHub

- Code management to decrease knowledge silos
- Improve activity visibility and documentation

Automate with Azure Data Factory or Synapse Pipelines

- Expose flows to teams
- Enable real-time monitoring and completion tracking

Unify the experience with Azure Synapse

AGENDA

1. Demo intelligent R & SQL
2. Demo Azure DevOps
3. Demo Azure Synapse Pipelines (Data Factory)
4. Azure Synapse Bonus Content

DEMO 1

Intelligent R & SQL

- a) R Desktop: “Bad-Case Scenario”
- b) R on the Server: An interim solution
- c) R in the database & Azure Data Studio

ImpactSOA - RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

Go to file/function Addins

cubist_example.R*

```
1 #required
2 install.packages('mlbench', type='binary')
3 install.packages('Cubist', type='binary')
4
5 #cubist example
6 library(Cubist)
7 library(mlbench)
8 data(BostonHousing) ←
9
10 ## 1 committee, so just an M5 fit:
11 mod1 <- cubist(x = BostonHousing[, -14], y = BostonHousing$medv)
12 mod1
13
14 ## Now with 10 committees
15 mod2 <- cubist(x = BostonHousing[, -14], y = BostonHousing$medv, committees = 10)
16 mod2
```

(Top Level)

Console Terminal Jobs

R 3.5.2 · ~/Desktop/ImpactSOA/

> mod1

```
Call:
cubist.default(x = BostonHousing[, -14], y = BostonHousing$medv)

Number of samples: 506
Number of predictors: 13

Number of committees: 1
Number of rules: 4
```

>

```
> ## Now with 10 committees
> mod2 <- cubist(x = BostonHousing[, -14], y = BostonHousing$medv, committees = 10)
> mod2
```

```
Call:
cubist.default(x = BostonHousing[, -14], y = BostonHousing$medv, committees = 10)

Number of samples: 506
Number of predictors: 13

Number of committees: 10
Number of rules per committee: 4, 6, 4, 6, 6, 7, 7, 7, 4, 5
```

Run Source

Environment History Connections Tutorial

Import Dataset 221 MiB Global Environment

Data

BostonHousing	506 obs. of 14 variables
mod1	List of 14
mod2	List of 14

List

Run

Source

Environment History Connections Tutorial

Import Dataset 221 MiB Global Environment

Data

BostonHousing	506 obs. of 14 variables
mod1	List of 14
mod2	List of 14

Files Plots Packages Help Viewer

Cubist

R: Fit a Cubist model Find in Topic

Quinlan. C4.5: Programs For Machine Learning (1993b) Morgan Kaufmann Publishers Inc. San Francisco, CA

Wang and Witten. Inducing model trees for continuous classes. Proceedings of the Ninth European Conference on Machine Learning (1997) pp. 128-137

<http://rulequest.com/cubist-info.html>

See Also

[cubistControl\(\)](#), [predict.cubist\(\)](#), [summary.cubist\(\)](#), [dotplot.cubist\(\)](#), [caret::train\(\)](#)

Examples

```
library(mlbench)
data(BostonHousing)

## 1 committee, so just an M5 fit:
mod1 <- cubist(x = BostonHousing[, -14], y = BostonHousing$medv)
mod1

## Now with 10 committees
mod2 <- cubist(x = BostonHousing[, -14], y = BostonHousing$medv, committees = 10)
mod2
```

[Package Cubist version 0.3.0 [Index](#)]

Diagram A

Desktop

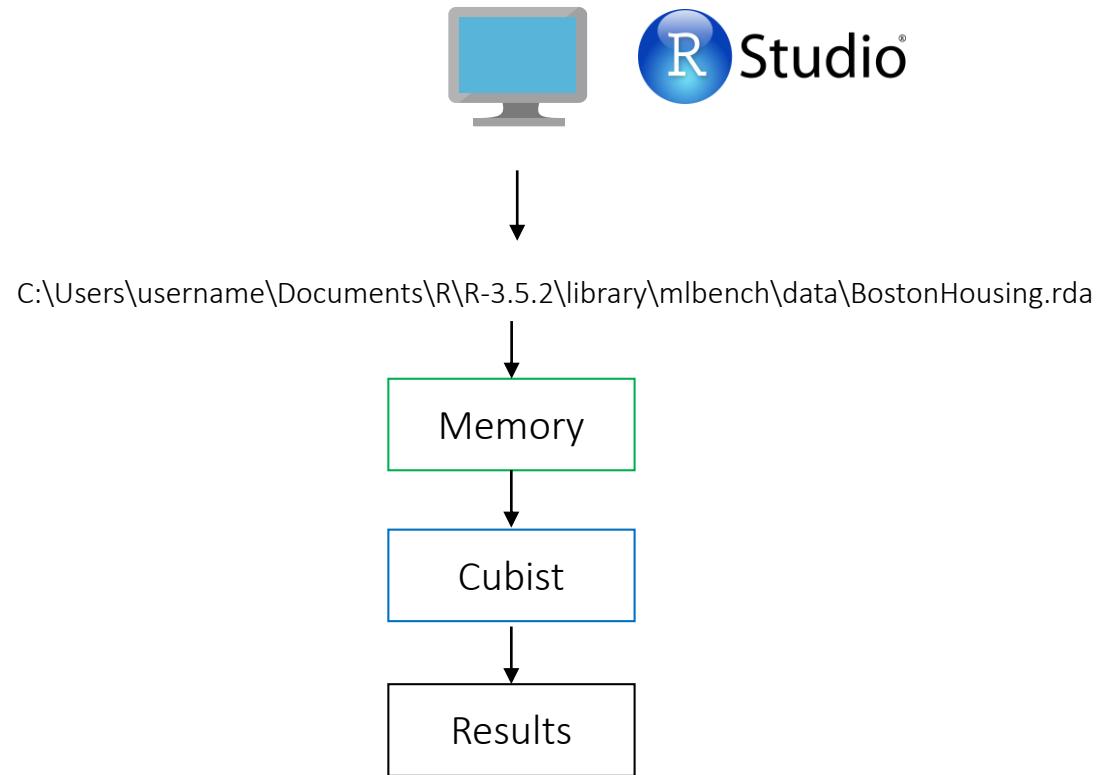
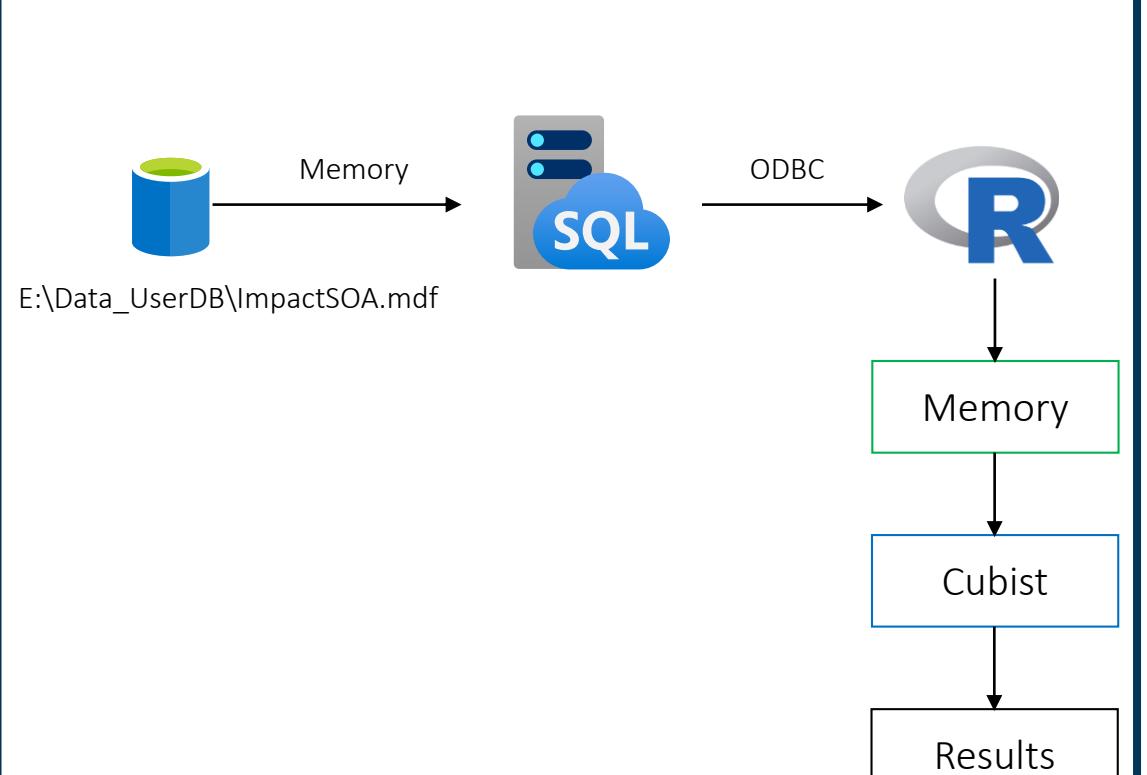


Diagram B

Server



ImpactSOA - RStudio

File Edit Code View Plots Session Build Debug Profile Tools Help

on_server_example.R* cubist_example.R

Source on Save Run Source

1 #required
2 install.packages('RODBC', type='binary')
3 install.packages('Cubist', type='binary')
4
5 #cubist example
6 library(Cubist)
7 library(RODBC)
8 connect <- odbcDriverConnect('driver={SQL Server};server=localhost;database=ImpactSOA;trusted_connection=true')
9 BostonHousing <- sqlQuery(channel=connect,query='select * from dbo.BostonHousing')
10
11 ## 1 committee, so just an M5 fit:
12 mod1 <- cubist(x = BostonHousing[, -14], y = BostonHousing\$medv)
13 mod1
14
15 ## Now with 10 committees
16 mod2 <- cubist(x = BostonHousing[, -14], y = BostonHousing\$medv, committees = 10)
17 mod2
18

10:1 (Top Level) R Script

Console Terminal Jobs

R 3.5.2 ~/Desktop/ImpactSOA/ > mod1

Call:
cubist.default(x = BostonHousing[, -14], y = BostonHousing\$medv)

Number of samples: 506
Number of predictors: 13

Number of committees: 1
Number of rules: 4

> mod2

Call:
cubist.default(x = BostonHousing[, -14], y = BostonHousing\$medv, committees = 10)

Number of samples: 506
Number of predictors: 13

Number of committees: 10
Number of rules per committee: 4, 6, 4, 6, 6, 7, 7, 7, 4, 5

>

Environment History Connections Tutorial

Import Dataset 194 MiB Global Environment

Data

BostonHousing	506 obs. of 14 variables
mod1	List of 14
mod2	List of 14

Files Plots Packages Help Viewer

R: Query an ODBC Database Find in Topic

sqlQuery {RODBC}

R Documentation

Query an ODBC Database

Description

Submit an SQL query to an ODBC database, and retrieve the results.

Usage

```
sqlQuery(channel, query, errors = TRUE, ..., rows_at_time)
sqlGetResults(channel, as.is = FALSE, errors = FALSE,
max = 0, bufsize = 1000,
nullstring = NA_character_, na.strings = "NA",
believeNRows = TRUE, dec = getOption("dec"),
stringsAsFactors = default.stringsAsFactors())
```

Arguments

channel	connection handle as returned by odbcConnect .
query	any valid SQL statement.

Diagram B

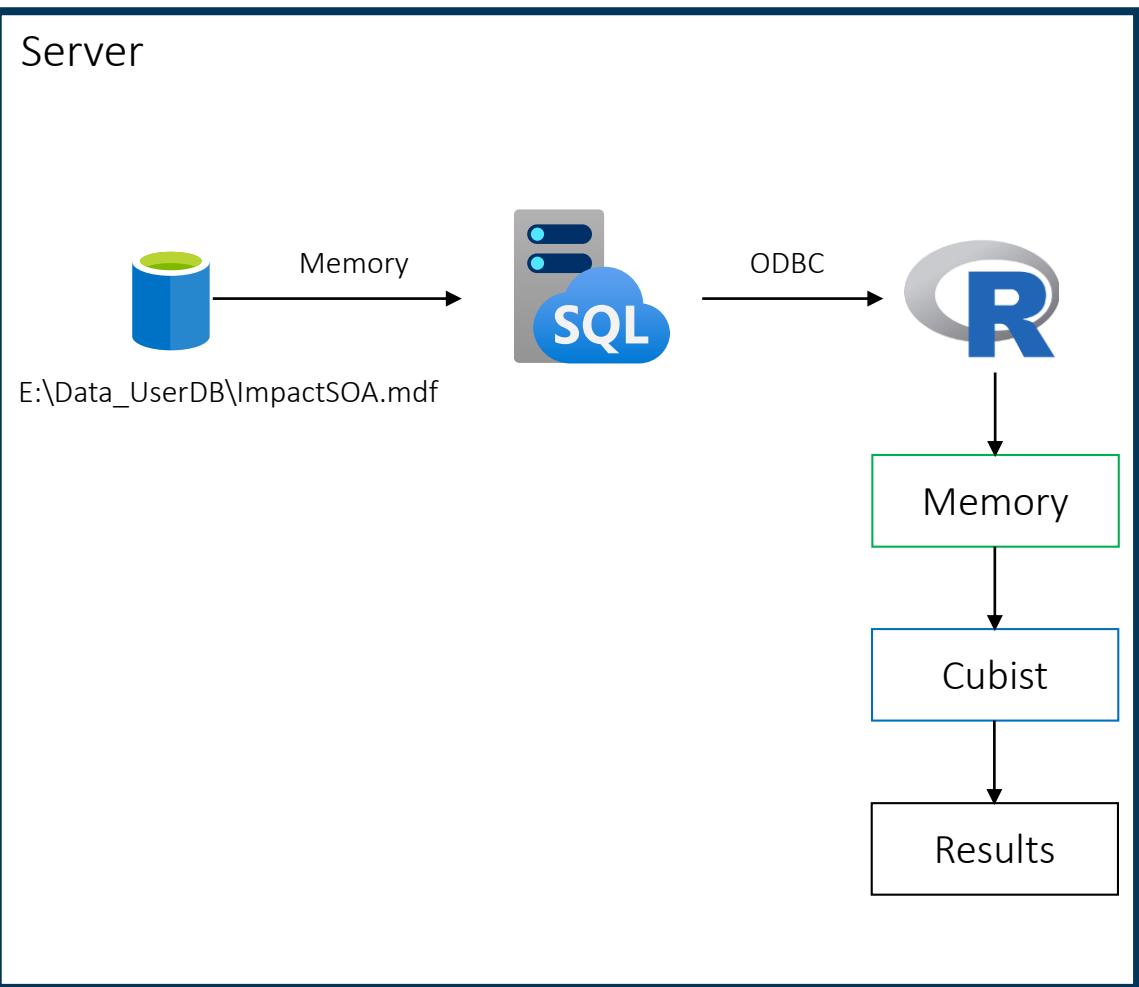
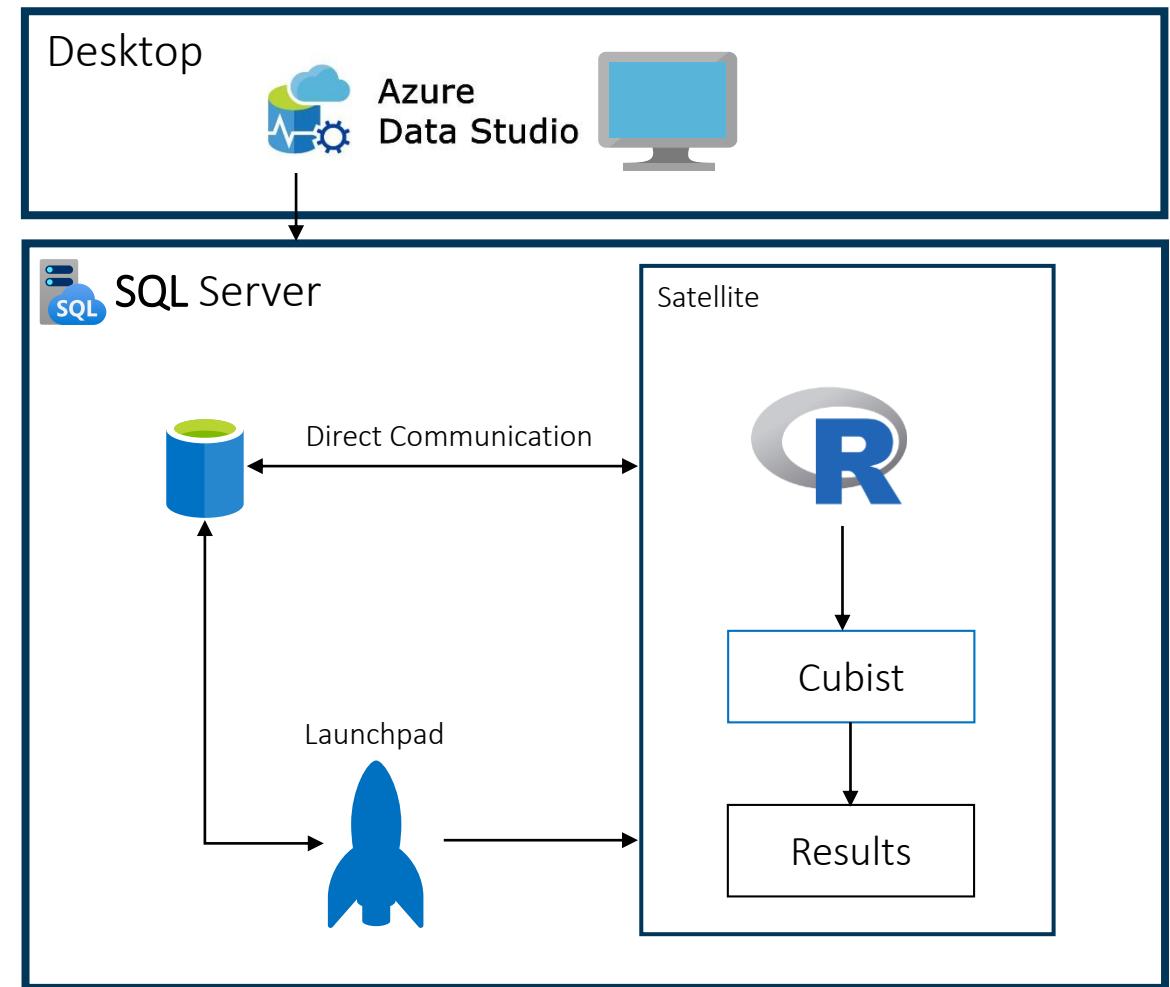


Diagram C



File Edit View Help • SQLEngine_AzureDataStudio_Sample.ipynb internal_model (Workspace) - Azure Data Studio

SQLEngine_AzureDataStudio_Sample.ipynb

ImpactSOA_repo > SOA-BasicsForActuaries > ImpactSOA_CodeSamples > SQLEngine_AzureDataStudio_Sample.ipynb

+ Cell ▾ Run all Kernel SQL Attach to [redacted]

[21] 1 CREATE EXTERNAL LIBRARY Cubist FROM (CONTENT = 'E:/ServerPackageDirectory/Cubist_0.2.3.zip') WITH (LANGUAGE = 'R');
2 CREATE EXTERNAL LIBRARY mlbench FROM (CONTENT = 'E:/ServerPackageDirectory/mlbench_2.1-1.zip') WITH (LANGUAGE = 'R');

Commands completed successfully.

Total execution time: 00:00:00.906

[23] 1 exec sp_execute_external_script
2 @language = N'R',
3 @script = N'
4 library(Cubist)
5 library(mlbench)
6 data(BostonHousing)
7
8 ## 1 committee, so just an M5 fit:
9 mod1 <- cubist(x = BostonHousing[, -14], y = BostonHousing\$medv)
10 print(mod1)
11
12 ## Now with 10 committees
13 mod2 <- cubist(x = BostonHousing[, -14], y = BostonHousing\$medv, committees = 10)
14 print(mod2)
15 ';

STDERR message(s) from external script: Warning messages: 1: package 'Cubist' was built under R version 3.5.3 2: package 'mlbench' was built under R version 3.5.3

STDOUT message(s) from external script: Call: cubist.default(x = BostonHousing[, -14], y = BostonHousing\$medv) Number of samples: 506 Number of predictors: 13 Number of committees: 1 Number of rules: 4 Call: cubist.default(x = BostonHousing[, -14], y = BostonHousing\$medv, committees = 10) Number of samples: 506 Number of predictors: 13 Number of committees: 10 Number of rules per committee: 4, 6, 4, 6, 6, 7, 7, 7, 4, 5

Total execution time: 00:00:02.440

master* 6 △ 0 Choose SQL Language

Resources Demo 1

- <https://github.com/hfleitas/SOA-BackToBasicsAnalyticsForActuaries>
- <https://rstudio.com/products/rstudio/download>
- [Reading data from Microsoft SQL Server into R - Stack Overflow](#)
- [Install on Windows - SQL Server Machine Learning Services | Microsoft Docs](#)
- [R language extension - SQL Server Machine Learning Services | Microsoft Docs](#)
- [CREATE EXTERNAL LIBRARY \(Transact-SQL\) - SQL Server - SQL Server | Microsoft Docs](#)

DEMO 2

Azure DevOps

- a) Boards
- b) Repos: enable more rapid actuarial development
- c) Pipelines: maturing to CI/CD

FabrikamFiber Board

New Active 5/5 Staging 15/15 Deployed 3/3

	New	Active	Staging	Deployed
New item				
Hotels filter page	Home page (selected room) Carlos Slattery <small>Xamarin</small>	Home page (no room selected) Kat Larson <small>Design</small>	Mobile (Spike) Celeste Burton <small>Design</small>	
Guests page	Top page controls Celeste Burton <small>ML Xamarin</small>	Entry + validations Carole Poland	Footer Cecil Folk <small>ML Xamarin</small>	
NFC open door	Search component complex features Cecil Folk <small>General Xamarin</small>	Navigation menu Carlos Slattery <small>AL Xamarin</small>	Code of Conduct Celeste Burton <small>General Xamarin</small>	
Room Tab	Images from api Carole Poland <small>General</small>	Login page Celeste Burton <small>Blocked Xamarin</small>		
Map filter	Adapt some parts of UI to UWP for Desktop Carole Poland <small>Blocked Xamarin</small>	Ambient settings Carlos Slattery <small>Xamarin</small>		
Hotel reviews page	Notifications list Carole Poland <small>General</small>			

[Project settings](#)

AW AdventureWorks Mobile

- Overview
- Boards
- Repos**
- Files
- Commits
- Pushes
- Branches
- Tags
- Pull requests**
- Pipelines
- Test Plans
- Artifacts

Project settings

Pull requests

[+ New Pull Request](#)[Mine](#) [Active](#) [Completed](#) [Abandoned](#)

Created by me

- Initialize client with .client.init**
Celeste Burton requested #238 into master 0
3 minutes ago

- Use latest React version**
Celeste Burton requested #230 into features/react-update 0
1 hour ago

Assigned to me

- Check returned identity for null status**
Colin Ballinger requested #212 into master 0
new pull request • 15 minutes ago

- [WIP] Add tests for reticulating splines**
Robin Counts requested #221 into master 0
4 hours ago

Assigned to my team

- Add exception mappings for disconnect**
Colin Ballinger requested #249 into master 5
2 comments • 15 minutes ago

- Maintain folder structure when converting isomorphs**
Robin Counts requested #234 into master 0
1 hour ago

- Testing configuration settings**
Robin Counts requested #239 into master 2
3 hours ago

- Hotfix payload to Orion**
Robin Counts requested #201 into releases/orion 3
5 hours ago

```
251 export interface SaveInfoBannerProps {  
252   saveInfo: SaveInfo;  
253   versionSpec: VersionSpec;  
254   interface CommitLinkProps {  
255     url: string;  
256     text: string;  
257     tooltip: string;  
258     prefixMessage: string;  
259   }  
}
```

```
251 export interface SaveInfoBannerProps {  
252   saveInfo: SaveInfo;  
253   versionSpec: VersionSpec;  
254   interface CommitLinkProps {  
255     url: string;  
256     + targetHubId: string;  
257     text: string;  
258     tooltip: string;  
259     prefixMessage: string;  
260   }  
}
```



Liam Parker

@Chloe Clark `const CommitLink = ({ prefixMessage, url, tooltip, text }:`

Chloe Clark



Can we try what we did in [User Story 567435](#)



Liam Parker

Yeah, that would be a better pattern, I'll make the change in my next update

1

Chloe Clark



Awesome!

- AdventureWorks
- Overview
- Pipelines
- Builds
- Releases
- Library
- Deployment groups

Project settings

Enabling feature flags for Preview Attachment and Grid Views

AdventureWorks/PackageFramework master #889

Summary Logs Tests YAML

Job Type	Status	Duration
Windows Job	Running	1m 53s
Linux Job	Running	3m 29s
macOS Job	Running	3m 07s

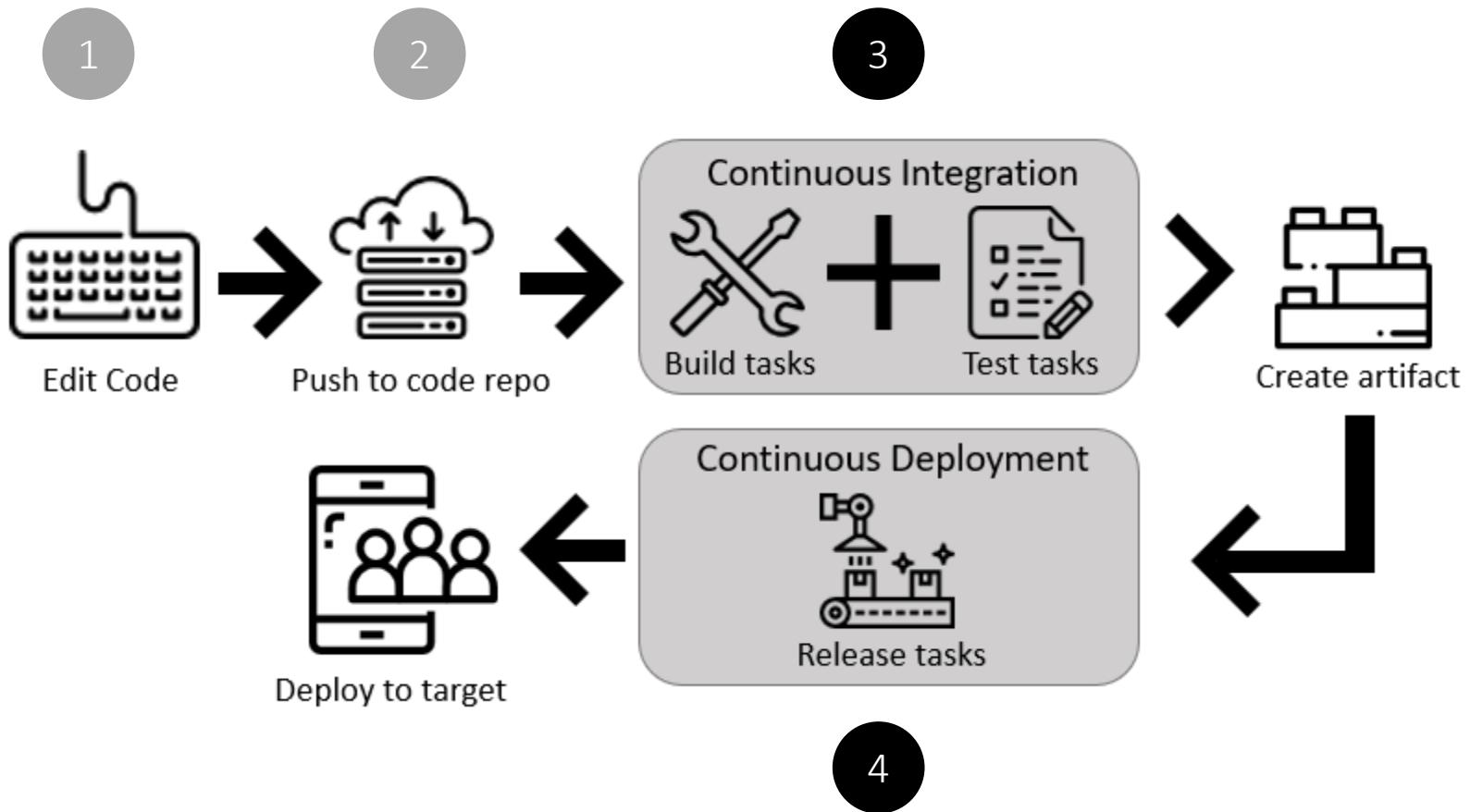
Linux Job

Agent: Hosted Linux

Step	Time
Prepare job	<1s
Initialize job	1s
Get sources	24s
Cmdline	28s
Nodetool	3s
Install dependencies	2m 31s

```
yarn install v1.7.0
$ node build/npm/preinstall.js
[1/4] ⚡ Resolving packages...
[2/4] 🛡 Fetching packages...
[3/4] ⚡ Linking dependencies...
[4/4] 🏭 Building fresh packages...
$ npm run compile
[########################################-----] 152/243
> code-oss-dev-build@1.0.0 compile ./adventureworks/build
> tsc -p tsconfig.build.json

⚡ Done in 4.89s.
$ node ./postinstall
[##] 2/2 removed './adventureworks/extensions/node_modules/typescript/lib/tsc.js'
removed './adventureworks/extensions/node_modules/typescript/lib/tsserverlibrary.d.ts'
removed './adventureworks/extensions/node_modules/typescript/lib/tsserverlibrary.js'
removed './adventureworks/extensions/node_modules/typescript/lib/typescriptServices.d.ts'
removed './adventureworks/extensions/node_modules/typescript/lib/typescriptServices_is'
```



Ref: <https://docs.microsoft.com/azure/devops/pipelines/get-started/pipelines-get-started>

Azure DevOps interface showing the Pipelines page for the dw-Cl pipeline.

The pipeline has four stages, all of which have passed successfully (indicated by green checkmarks).

Recent pipeline runs:

- #25 Merge branch 'main' of https://github.com/hfleitas/synapsedelta (Sep 15, 43s)
- #24 fixed dacpac (Sep 15, 1m 38s)
- #7 added devops json pipelines (Sep 10, 41s)
- #6 Merge branch 'main' of https://github.com/hfleitas/synapsedelta (Sep 10, 46s)

Run pipeline button is available at the top right.

Description	Stages	Date	Duration
#25 Merge branch 'main' of https://github.com/hfleitas/synapsedelta ↳ Individual CI for main ↳ 5aeedc8c	✓	Sep 15	43s
#24 fixed dacpac ↳ Individual CI for main ↳ 07668a04	✓	Sep 15	1m 38s
#7 added devops json pipelines ↳ Individual CI for main ↳ 44bd0d62	✓	Sep 10	41s
#6 Merge branch 'main' of https://github.com/hfleitas/synapsedelta ↳ Manually triggered for main ↳ d8003ef8	✓	Sep 10	46s

Pipelines - Run 25 artifacts

https://dev.azure.com/hiramfleitas0814/dw/_build/results?buildId=25&view=artifacts&pathAsName=false&type=publishedArtifacts

Azure DevOps

hiramfleitas0814 / dw / Pipelines / dw-CL / 25 / Published artifacts

Search

dw

Overview

Boards

Repos

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Pipelines

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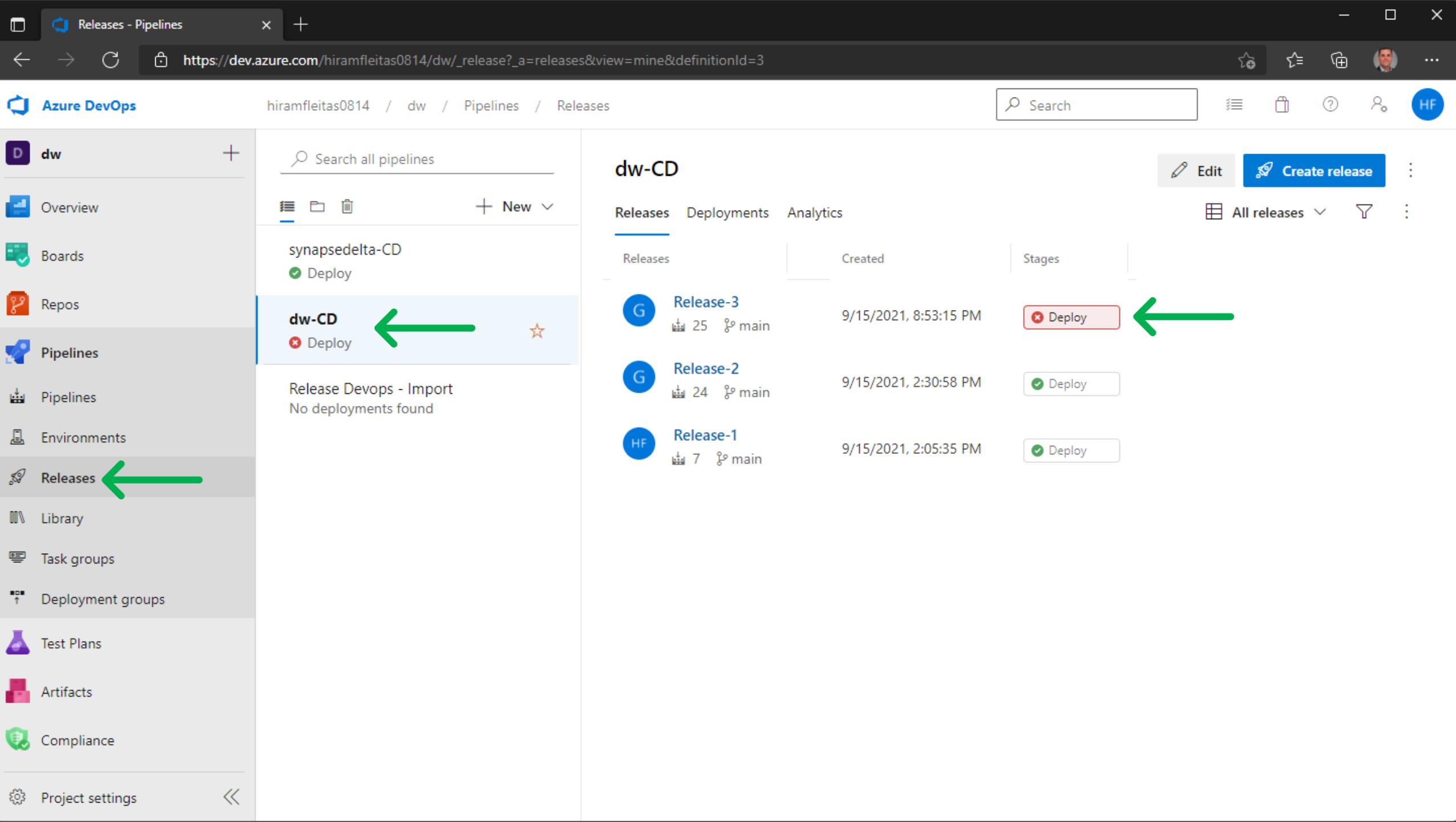
Artifacts

Published Consumed

Name Size

Name	Size
drop	18 KB
wplussynapsedw.dacpac	5 KB
wplussynapsedw.dll	4 KB
wplussynapsedw.pdb	10 KB

A green arrow points upwards from the artifact list towards the pipeline navigation bar. A blue arrow points to the 'wplussynapsedw.dacpac' file in the list.



dw-CD - Release-3 - Pipelines

https://dev.azure.com/hiramfleitas0814/dw/_releaseProgress?a=release-environment-logs&releaseId=22&environmentId=22

Azure DevOps hiramfleitas0814 / dw / Pipelines / Releases / dw-CD / Release-3 Search

D dw + dw-CD > Release-3 > Deploy Failed

Overview Boards Repos Pipelines Environments Releases Library Task groups Deployment groups Test Plans Artifacts Compliance Project settings

Pipeline Tasks Variables Logs Tests Deploy Cancel Refresh Download all logs Edit ...

Deployment process Failed

Agent job Failed · 3 errors

Agent job

Pool: Azure Pipelines · Agent: Hosted Agent Started: 9/15/2021, 8:53:39 PM ... 45s

Initialize job · succeeded 11s

Download artifact - _dw-CD - drop · succeeded 3s

Get Dacpac Script · 3 errors 30s

*** An error occurred during deployment plan generation. Deployment cannot continue.

Failed to import target model wplussynapsesdw. Detailed message Cannot connect to database when it is paused.

Cannot connect to database when it is paused.

The Azure SQL DACPAC task failed. SqlPackage.exe exited with code 1. Check out how to troubleshoot failures at <https://aka.ms/sqlazuredeployreadme#troubleshooting>

Show Dacpac Script · skipped ⓘ

Publish Dacpac (Deploy) · skipped ⓘ

Finalize Job · succeeded <1s

dw-CD - Release-2 - Pipelines

https://dev.azure.com/hiramfleitas0814/dw/_releaseProgress?a=release-environment-logs&releaseId=21&environmentId=21

Azure DevOps

dw

Overview Boards Repos Pipelines Pipelines Environments Releases Library Task groups Deployment groups Test Plans Artifacts Compliance Project settings

Publish Dacpac (Deploy)

1 2021-09-15T18:46:09.4872626Z ##[section]Starting: Publish Dacpac (Deploy)
2 2021-09-15T18:46:09.5051629Z =====
3 2021-09-15T18:46:09.5052192Z Task : Azure SQL Database deployment
4 2021-09-15T18:46:09.5052573Z Description : Deploy an Azure SQL Database using DACPAC or run scripts using SQLCMD
5 2021-09-15T18:46:09.5052865Z Version : 1.184.0
6 2021-09-15T18:46:09.5053151Z Author : Microsoft Corporation
7 2021-09-15T18:46:09.5053513Z Help : <https://docs.microsoft.com/azure/devops/pipelines/tasks/deploy/sql-azure-dacpac-deployment>
8 2021-09-15T18:46:09.5054292Z =====
9 2021-09-15T18:46:14.7066678Z Temporary inline SQL file: C:\Users\VssAdministrator\AppData\Local\Temp\tmp9349.tmp
10 2021-09-15T18:46:14.7426777Z Invoke-Sqlcmd -ServerInstance "hfpocts1.sql.azuresynapse.net" -Database "wpplussynapsedw" -Username "sqladminuser" -Pa
11 2021-09-15T18:46:26.1209698Z DACPAC file path: D:\a\r1\a_dw-CI\drop\wpplussynapsedw.dacpac
12 2021-09-15T18:46:26.3561949Z ##[command]"D:\a_tasks\SqlAzureDacpacDeployment_ce85a08b-a538-4d2b-8589-1d37a9ab970f\1.184.0\vswhere.exe" -version [1
13 2021-09-15T18:46:26.4508936Z "C:\Program Files\Microsoft SQL Server\150\DAC\bin\SqlPackage.exe" /Action:Publish /SourceFile:"D:\a\r1\a_dw-CI\drop\wpplussynapsedw.dacpac" /TargetConnectionString:"Data Source=hfpocts1.sql.azuresynapse.net;Initial Catalog=wpplussynapsedw;User Id=sqladminuser;Password=sqladminuser;Trusted_Connection=False;Encrypt=True;Connection Timeout=30"
14 2021-09-15T18:46:26.7992890Z Publishing to database 'wpplussynapsedw' on server 'hfpocts1.sql.azuresynapse.net'.
15 2021-09-15T18:46:30.7152019Z Initializing deployment (Start)
16 2021-09-15T18:47:39.4776453Z Initializing deployment (Complete)
17 2021-09-15T18:47:39.4794978Z Analyzing deployment plan (Start)
18 2021-09-15T18:47:39.5713872Z Analyzing deployment plan (Complete)
19 2021-09-15T18:47:39.5736200Z Updating database (Start)
20 2021-09-15T18:47:42.4104972Z Creating Table [dbo].[lastchanges]...
21 2021-09-15T18:47:43.1380807Z Update complete.
22 2021-09-15T18:47:45.2745342Z Updating database (Complete)
23 2021-09-15T18:48:07.3741358Z Successfully published database.
24 2021-09-15T18:48:07.3766129Z Time elapsed 0:01:40.62
25 2021-09-15T18:48:07.4838569Z ##[section]Finishing: Publish Dacpac (Deploy)
26

CONNECTIONS

...

SERVERS

- hfpocws1.database.windows.net, <default> (Hiram Fleitas - hir...
 - Databases
 - System Databases
 - hfpocws1p1
 - wplussynapsedw
 - Tables
 - dbo.Character
 - dbo.dateformats
 - dbo.dateformats2
 - dbo.devs
 - dbo.Episode
 - dbo.extDevs
 - dbo.heapTable
 - dbo.lastchanges
 - Columns
 - Constraints
 - Indexes
 - Statistics
 - dbo.Letters

AZURE

SQL SERVER BIG DATA CLUSTERS

CENTRAL MANAGEMENT SERVERS

master 0 0



Azure Data Studio

[New](#)[Open file...](#)[Open folder...](#)

Create a connection

Connect to a database instance through the connection dialog.



Run a query

Interact with data through a query editor.



Create a notebook

Build and run notebooks.



Deploy a server

Create a new instance of a

EXTENSIONS: MARKETPLACE ... Welcome Extension: SQL Database Projects X

project

SQL Database Projects 0.12.0
The SQL Database Projects extension for Az...
Microsoft

SQL Database Projects

microsoft.sql-database-projects

Microsoft | Repository | License | v0.12.0

The SQL Database Projects extension for Azure Data Studio allows users to develop ...

[Disable](#) [Uninstall](#) This extension is enabled globally.

This extension is recommended by Azure Data Studio.

[Details](#) [Feature Contributions](#) [Dependencies](#)

Microsoft SQL Server Database Projects for Azure Data Studio

Microsoft SQL Server Database Projects for Azure Data Studio includes:

Database Projects

The Database Projects extension provides a way to design, edit, and publish schemas for SQL databases from a source controlled project.

Please report issues and feature requests [here](#).

Getting Started with Database Projects

Resources Demo 2

- [Understand what you get with Azure Boards - Azure Boards | Microsoft Docs](#)
- [Azure Boards | Microsoft Azure](#)
- [About project boards - GitHub Docs](#)
- [Azure Repos – Git Repositories | Microsoft Azure](#)
- [Azure Pipelines | Microsoft Azure](#)
- [<https://microsoft.github.io/PartsUnlimited/iac/200.2x-1aC-CDAzureSQLdbwithVSTSandVS.html>](#)
- [<https://docs.microsoft.com/azure/devops/pipelines/targets/azure-sqldb>](#)
- [<https://docs.microsoft.com/sql/azure-data-studio/download-azure-data-studio>](#)

DEMO 3

Azure Synapse

- a) Pipelines for Orchestrating Automation
- b) Transformations: Data Flows (Spark in low-code)
- c) Data movement: Including on-premises sources

rig - Azure Data Factory

https://adf.azure.com/en-us/authoring/pipeline/Primer?factory=%2Fsubscriptions%2Feaab21d5-8ecd-4ef0-a0c4-92fac2e22875%2FresourceGroups%2Frig%2Fprovider...

Microsoft Azure | Data Factory > rig

Search

master branch | Validate all | Save all | Publish

Factory Resources | Primer | Trollhunters

Filter resources by name

Pipeline (10)

- notify
- Primer (selected)
- Scale
- TaxiDemo
- Trollhunters

50-powerbi (2)

Ext (3)

Dataset (20)

Data flows (4)

Power Query (Preview) (0)

Templates (0)

Primer Pipeline Diagram:

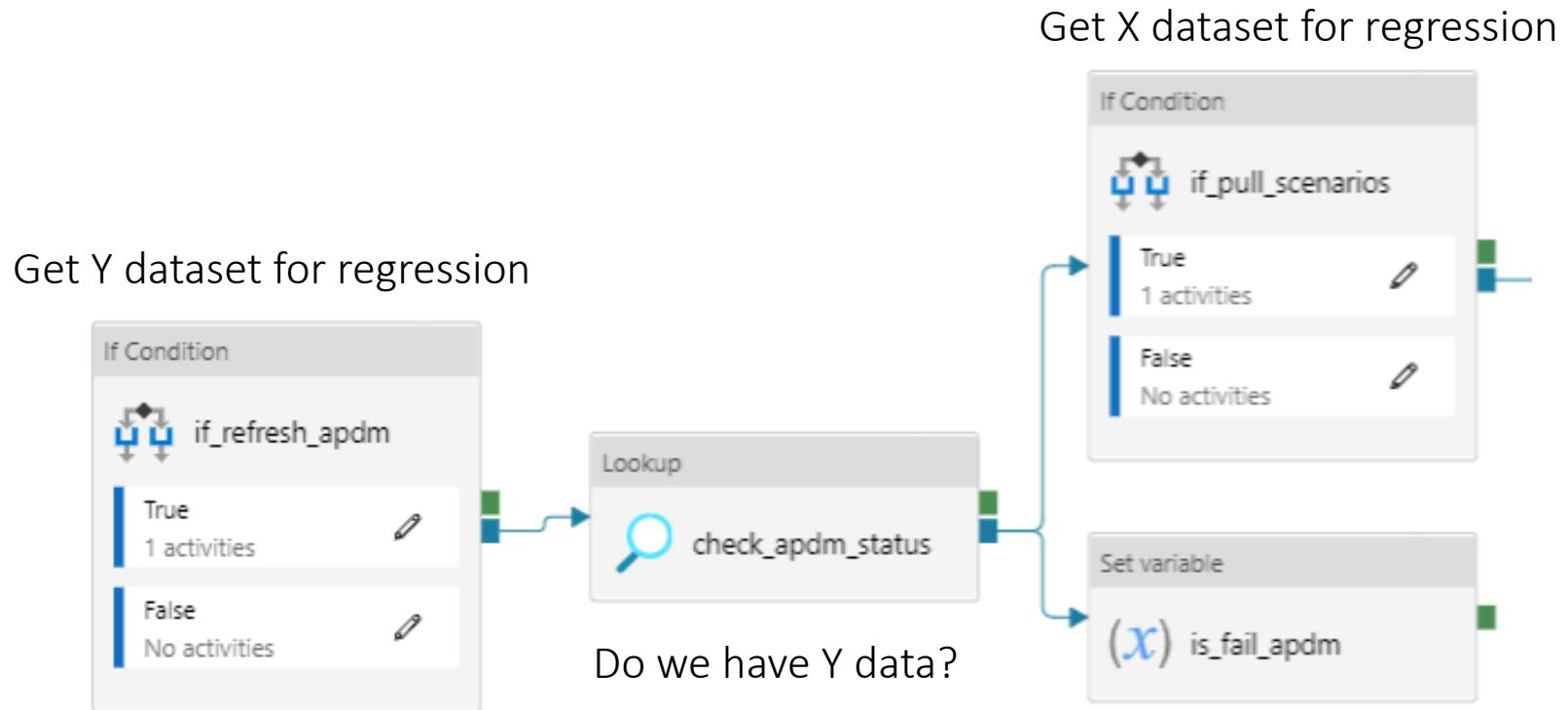
```
graph LR; GetStatus[GetStatus] --> IfCondition{If Condition: IfPausedThenOnline}; IfCondition -- True --> UntilOnline[Until: UntilOnline]; UntilOnline --> execTrollhunters[Execute Pipeline: execTrollhunters]; execTrollhunters --> GetStatusEnd[GetStatusEnd]; execTrollhunters --> Notify[Notify];
```

Parameters

New | Delete

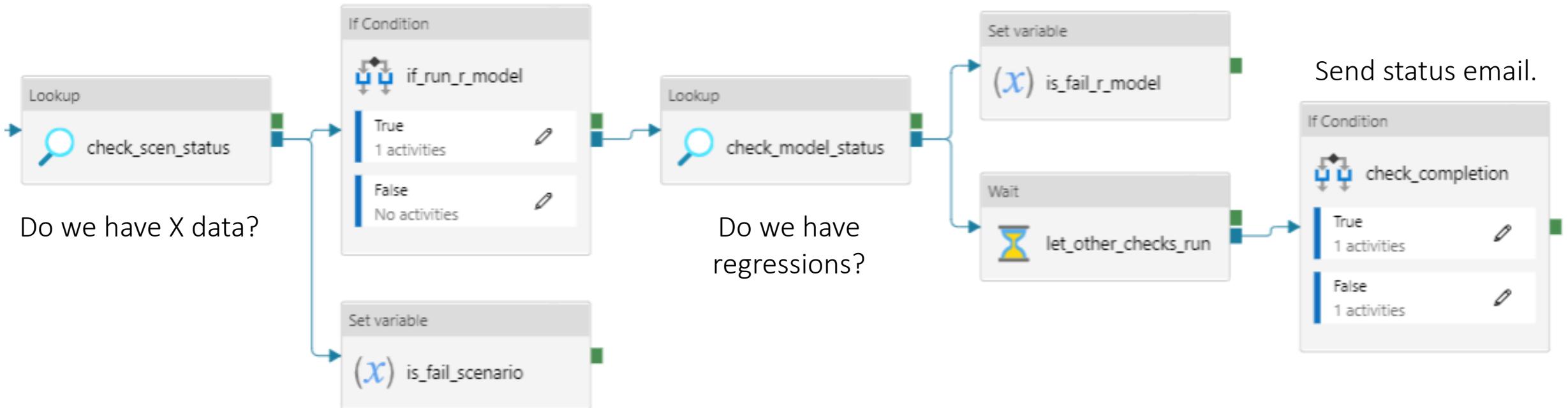
Name	Type	Default value
SubscriptionID	String	eaab21d5-8ecd-4ef0-a0c4-92fa
ResourceGroup	String	dw
Server	String	hiramdw
DW	String	dw
SLO	String	DW1000c
Notify	String	azure@fleitasarts.com

Pipeline: Publish Solvency II Model

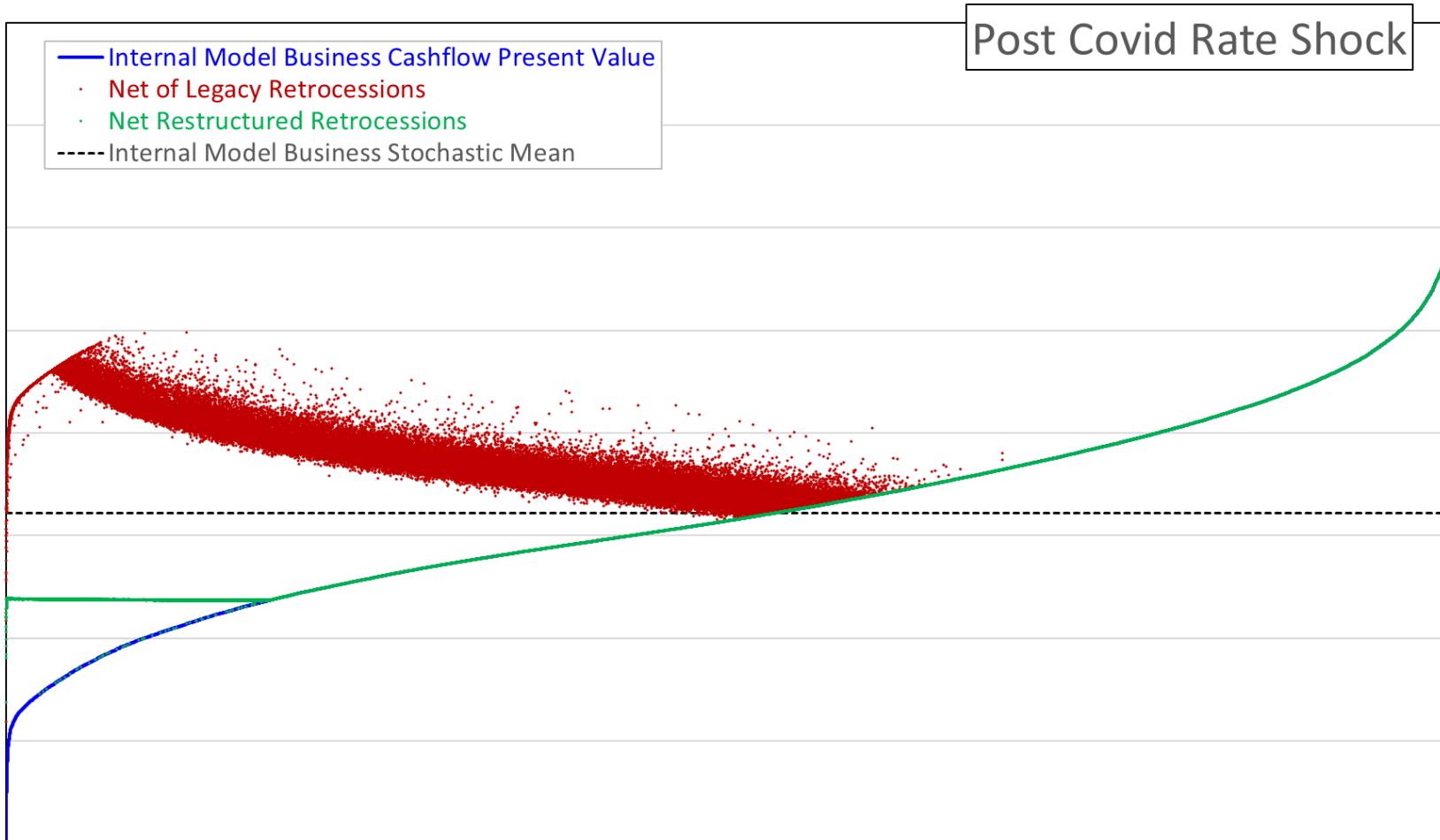


Cont'd

Run R regression models



Solvency II Impact: Effective Responses



Microsoft Azure | Synapse Analytics ▶

Brent.Carpentieri

Pipeline runs

Triggered Debug

 Rerun

[Cancel](#)

 Refresh

 Edit column

Lis

Gant

 Search by run ID or name

Local time : Last 30 days

Pipeline name : A

Status : All

Runs : Latest runs

Triggered by : All

 Add filter

 Copy filters

Pipeline name	Run start ↑	Run end	Duration	Triggered by	Status	Error	Run	Parameters	Actions
> enterprise	9/23/21, 1:44:17 PM	9/23/21, 2:26:52 PM	00:42:35	01135968-0582-40da-90	✓ Succeeded		Rerun (Latest)	[@]	
> general	9/23/21, 11:58:34 AM	9/23/21, 2:27:56 PM	02:29:22	Manual trigger	✓ Succeeded		Rerun (Latest)	[@]	
> run	9/20/21, 7:21:44 PM	9/21/21, 3:21:54 AM	08:00:09	0f09b118-6d92-49c7-b71	✗ Failed	✖	Rerun (Latest)	[@]	
> pipeline	9/20/21, 4:51:33 PM	9/21/21, 3:23:01 AM	10:31:28	Manual trigger	✓ Succeeded		Rerun (Latest)	[@]	
> test	9/17/21, 10:49:53 AM	9/17/21, 12:45:41 PM	01:55:48	Manual trigger	✓ Succeeded		Rerun (Latest)		
test	9/16/21, 9:31:26 AM	9/16/21, 11:02:34 AM	01:31:08	Manual trigger	✗ Cancelled	✖	Original		
test	9/15/21, 11:55:55 AM	9/15/21, 1:50:43 PM	01:54:48	Manual trigger	✓ Succeeded		Original		
test	9/15/21, 9:13:33 AM	9/15/21, 11:13:47 AM	02:00:14	Manual trigger	✓ Succeeded		Original		
relabel	9/1/21, 2:24:59 PM	9/1/21, 9:59:07 PM	07:34:07	ce012cf7-7c18-402f-834f	✓ Succeeded		Original	[@]	
enterprise	9/1/21, 12:07:27 PM	9/1/21, 2:23:29 PM	02:16:02	872a56e5-7c14-44a1-8a:	✓ Succeeded		Original	[@]	
general	9/1/21, 12:04:00 PM	9/1/21, 2:24:39 PM	02:20:38	e0dd1d61-e84c-4d05-92	✓ Succeeded		Original	[@]	
pipeline	9/1/21, 12:03:57 PM	9/1/21, 10:00:20 PM	09:56:22	Manual trigger	✓ Succeeded		Original	[@]	
> run	9/1/21, 9:56:44 AM	9/1/21, 10:47:12 AM	00:50:28	Manual trigger	✓ Succeeded		Rerun (Latest)	[@]	
pipeline	9/1/21, 12:14:20 AM	9/1/21, 9:35:38 AM	09:21:17	Manual trigger	✓ Succeeded		Original	[@]	
relabel	8/31/21, 10:26:43 PM	9/1/21, 12:07:20 AM	01:40:36	abe67b67-85c6-45a6-97:	✗ Cancelled	✖	Original	[@]	



Microsoft Azure | Synapse Analytics > https://web.azuresynapse.net/en-us/authoring/orchestrate/pipeline

Search

Update .NET Framework runtime version to 4.7.2 or above to allow upgrade of self-hosted integration runtime by 01 December 2020. View details

master branch / Validate all Commit all Publish

Committed Save as template Validate Debug Add trigger

If Condition
if_refresh_apdm
True 1 activities
False No activities

Lookup check_apdm_status

If Condition
if_pull_scenarios
True 1 activities
False No activities

Lookup check_scen_status

Set variable
(x) is fail_andm

Parameters Variables Settings Output

Name	Type	Default value
RunYear	Int	0
RunNumber	Int	0
UserEmail	String	Value
pull_apdm	Bool	false
pull_scenarios	Bool	false
run_r_model	Bool	false
projection_set	String	c(3,4,5)
skip_agent_jobs	Bool	false
full_erm_refresh	String	false

New trigger

Name * Weekly

Description

Type * Schedule

Start date * 09/03/2021 8:00 PM

Time zone * Coordinated Universal Time (UTC)

Recurrence * Every 1 Week(s)

Advanced recurrence options

Run on these days

Sun	Mon	Tue	Wed	Thu	Fri	Sat
-----	-----	-----	-----	-----	-----	-----

Execute at these times

Hours 20 X

Minutes 0 X

Schedule execution times 20:00

Specify an end date

Annotations

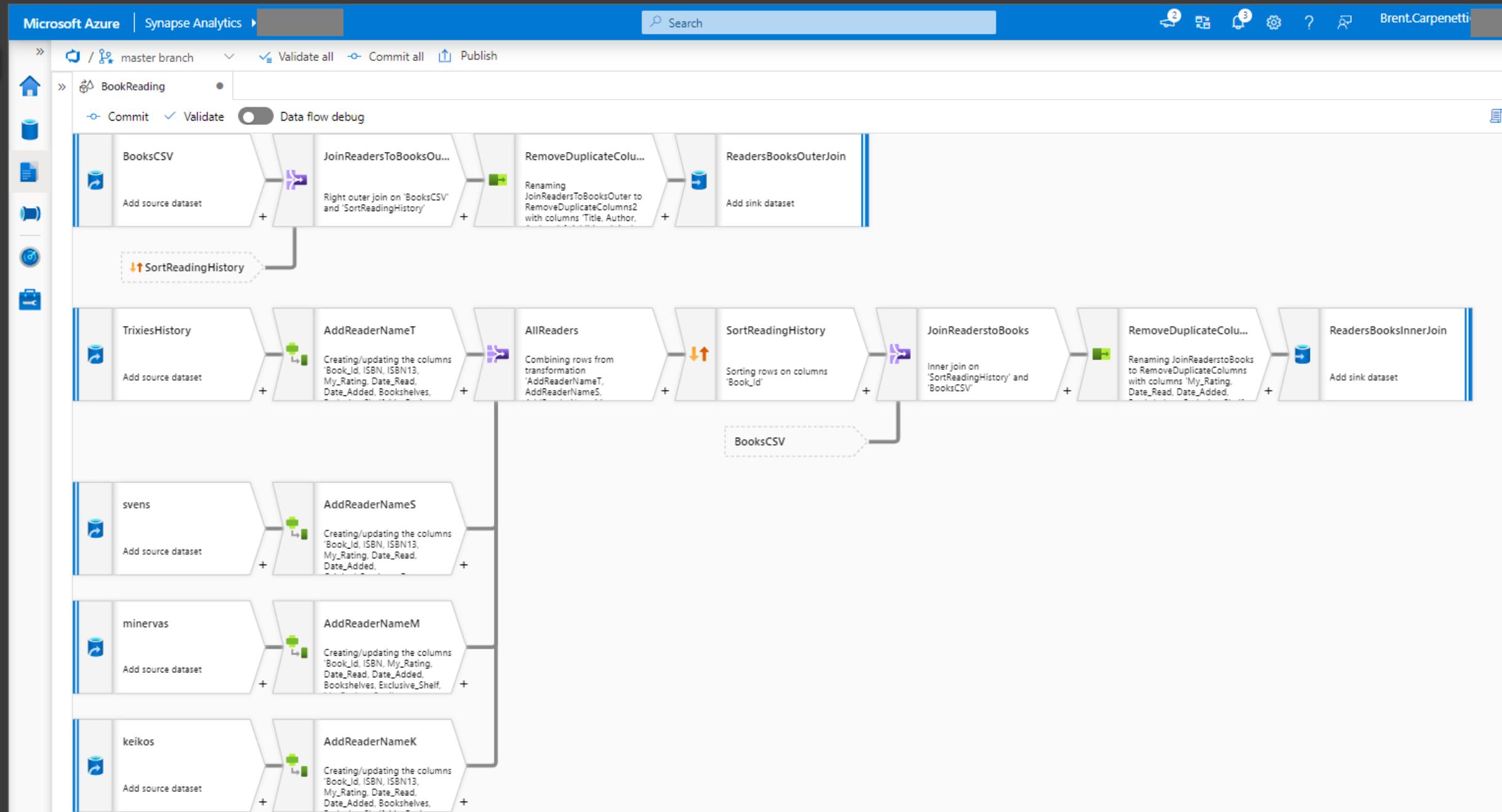
+ New

Start trigger Start trigger on creation

Commit Cancel

Tips and Tricks

- Diagram your flow on a whiteboard before building the application
- Identify what data elements are dimensions or facts early on
- Sink/Stage/Write data at key process steps to create “checkpoints”
- Normalize your data before running machine learning or regressions
 - Data science refers to this as data cleansing
 - Connect with IT and check if a data model already exists (it likely does!)
- If you work on big data (Petabyte - structured/unstructured)
 - Consider defining unique, indexed, primary keys to improve join performance
 - Consider Spark compute resources (ADB/SynapseSpark) for transformations





East US

On-prem data centers

**Integration
Runtime**
(Managed-elastic)

Orlando

Data Movement
Execution in
Orlando

Compute Activity
Dispatching
Dispatch from
Orlando

File Share

Database

meta-data &
pipeline
trigger in East
US

**Integration
Runtime**
(Managed-dedicated)

Denver

Execute Stored Proc
Execution in
Denver

Database

Database

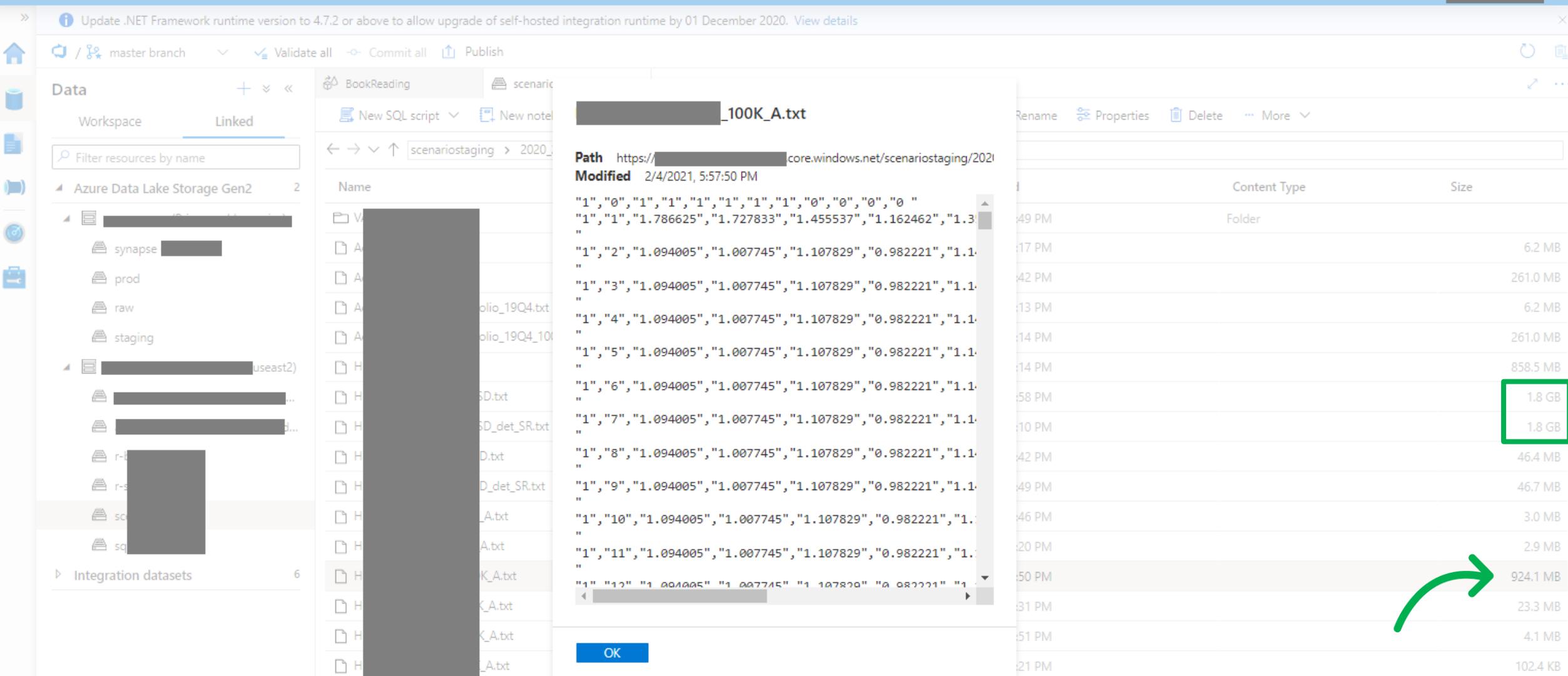
Resources Demo 3

- <https://github.com/hfleitas/rig/blob/master/pipeline/Primer.json>
- <https://docs.microsoft.com/azure/data-factory/solution-templates-introduction>
- [Azure Synapse Paths | Microsoft Learn](#)
- [Data integration at scale with Azure Data Factory or Azure Synapse Pipeline](#)
- [Use stored procedures - Azure Synapse Analytics | Microsoft Docs](#)

BONUS

Azure Synapse

- a) Data exploration
- b) Notebook development
- c) Server-less pools
- d) Purview: Data Dictionary & Process Flows



master branch   Validate all  Commit all  Publish

»  Boston house price ... ●

| ⌂ ⌁ Undo | ⌂ ⌁ Commit Outline

Attach to ecmSp

k

10

Language

Pw

Mark (Python)

Variables

1

Preview Features ⓘ

1

1

Boston house price prediction with Vowpal Wabbit, LightGBM

This notebook shows how to build simple regression models by using [Vowpal Wabbit \(vw\)](#) and [LightGBM](#) with MMLSpark. We also compare the results with [Spark MLlib Linear Regression](#).

+ Code

+ Markdown

```
1 import math
2 from matplotlib.colors import ListedColormap, Normalize
3 from matplotlib.cm import get_cmap
4 import matplotlib.pyplot as plt
5 from mmlspark.train import ComputeModelStatistics
6 from mmlspark.vw import VowpalWabbitRegressor, VowpalWabbitFeaturizer
7 from mmlspark.lightgbm import LightGBMRegressor
8 import numpy as np
9 import pandas as pd
10 from pyspark.ml.feature import VectorAssembler
11 from pyspark.ml.regression import LinearRegression
12 from sklearn.datasets import load_boston
```

[1] ✓ - Command executed in 4 sec 112 ms on 2:11:58 AM, 5/25/21

Prepare Dataset

We use [Boston house price dataset](#). The data was collected in 1978 from Boston area and consists of 506 entries with 14 features including the value of homes. We use `sklearn.datasets` module to download it easily, then split the set into training and testing by 75/25.

```
1 boston = load_boston()
2
3 feature_cols = ['f' + str(i) for i in range(boston.data.shape[1])]
4 header = ['target'] + feature_cols
5 df = spark.createDataFrame(
6     pd.DataFrame(data=np.column_stack((boston.target, boston.data)), columns=header)
7 ).repartition(1)
8 print("Dataframe has {} rows".format(df.count()))
9 display(df.limit(10).toPandas())
```

master branch Validate all Commit all Publish

Boston house price ...

Run all Undo Commit Outline

Attach to ecmSpark

Language

PySpark (Python)

Variables

Preview Features

...

Not started

Table of contents

Boston house price prediction with...

- Prepare Dataset
- Baseline - Spark MLlib Linear Regressor
- Vowpal Wabbit
- LightGBM
- Clean up resources
- Next steps

LightGBM

+ Code

+ Markdown

```
1 lgr = LightGBMRegressor(  
2     objective='quantile',  
3     alpha=0.2,  
4     learningRate=0.3,  
5     numLeaves=31,  
6     labelCol='target',  
7     numIterations=100,  
8 )  
9  
10 # Using one partition since the training dataset is very small  
11 repartitioned_data = lr_train_data.repartition(1).cache()  
12 print(repartitioned_data.count())  
13 lg_model = lgr.fit(repartitioned_data)  
14 lg_predictions = lg_model.transform(lr_test_data)  
15  
16 display(lg_predictions.limit(10).toPandas())
```

[12] ✓ - Command executed in 2 sec 80 ms on 2:12:37 AM, 5/25/21

377

View

Table

Chart

Export results

7.8555181506504566

9.408284298711045

10.125545304878454

11.009850748168407

11.378612631892928

11.705711758454298

11.789698630551646

prediction

target

+

Query folders and multiple files

Description

Serverless SQL pool supports reading multiple files/folders by using wildcards, which are similar to the wildcards used in Windows OS. However, greater flexibility is present since multiple wildcards are allowed.

Tags

Serverless SQL pool Sample Sample Data
 Folder Query Files

Preview

```
-- /* Multiple wildcards */
70
71  /* Read all files from multiple folders */
72  SELECT
73      YEAR(pickup_datetime) AS [year],
74      SUM(passenger_count) AS passengers_total,
75      COUNT(*) AS [rides_total]
76  FROM OPENROWSET(
77      BULK 'https://sqlondemandstorage.blob.core.windows.net/public-csv/t\*i/',
78      FORMAT = 'CSV', PARSER_VERSION = '2.0',
79      FIRSTROW = 2
80  )
81  WITH (
82      vendor_id VARCHAR(100) COLLATE Latin1_General_BIN2,
83      pickup_datetime DATETIME2,
84      dropoff_datetime DATETIME2,
85      passenger_count INT,
86      trip_distance FLOAT,
87      rate_code INT,
88      store_and_fwd_flag VARCHAR(100) COLLATE Latin1_General_BIN2,
89      pickup_location_id INT,
90      dropoff_location_id INT,
91      payment_type INT,
92      fare_amount FLOAT,
93      extra FLOAT,
94      mta_tax FLOAT,
95      tip_amount FLOAT,
96      tolls_amount FLOAT,
97      improvement_surcharge FLOAT,
98      total_amount FLOAT
99  ) AS nyc
100 GROUP BY
101     YEAR(pickup_datetime)
102 ORDER BY
103     YEAR(pickup_datetime);
104
105 /* Multiple wildcards */
106 SELECT
107     YEAR(pickup_datetime) AS [year],
```

You will be charged \$5/TB of data processed. The minimum charge is for 10MB with 1MB increments. [Learn more](#)



Adatum Corp

13,020 users

1,134 sources

76,392,971 assets

312 terms



Revenue

Search suggestions

revenue customer

revenue finance

revenue glossary

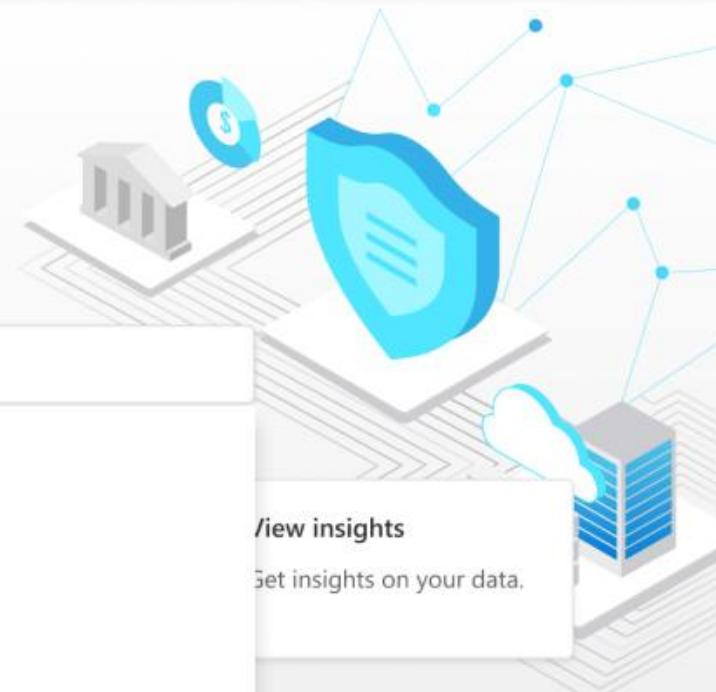
revenue information



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Asset suggestions

TaxRevenue

teradata://adatumteradata.retail.com/DB/TaxRevenue

CustomerRevenue_{N}

https://adatumcostorage.blob.core.windows.net/CUST/CustomerRevenue_{N}.csv

Revenue

https://adatumco.dfs.core.windows.net/incr/raw/revenue

Revenue2020.tsv

https://adatumco.dfs.core.windows.net/sales/Revenue2020.tsv

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Name

[Order](#)[Percent Sales](#)[SalesOrderHeader](#)[ProductCategory](#)[SSNNumber](#)[SalesLT.SalesOrderHeader.csv](#)[View all recently accessed](#)

Asset

10 days ago

references, etc.

Asset

1 month ago



Campaign Analytics

Confidential

Certified

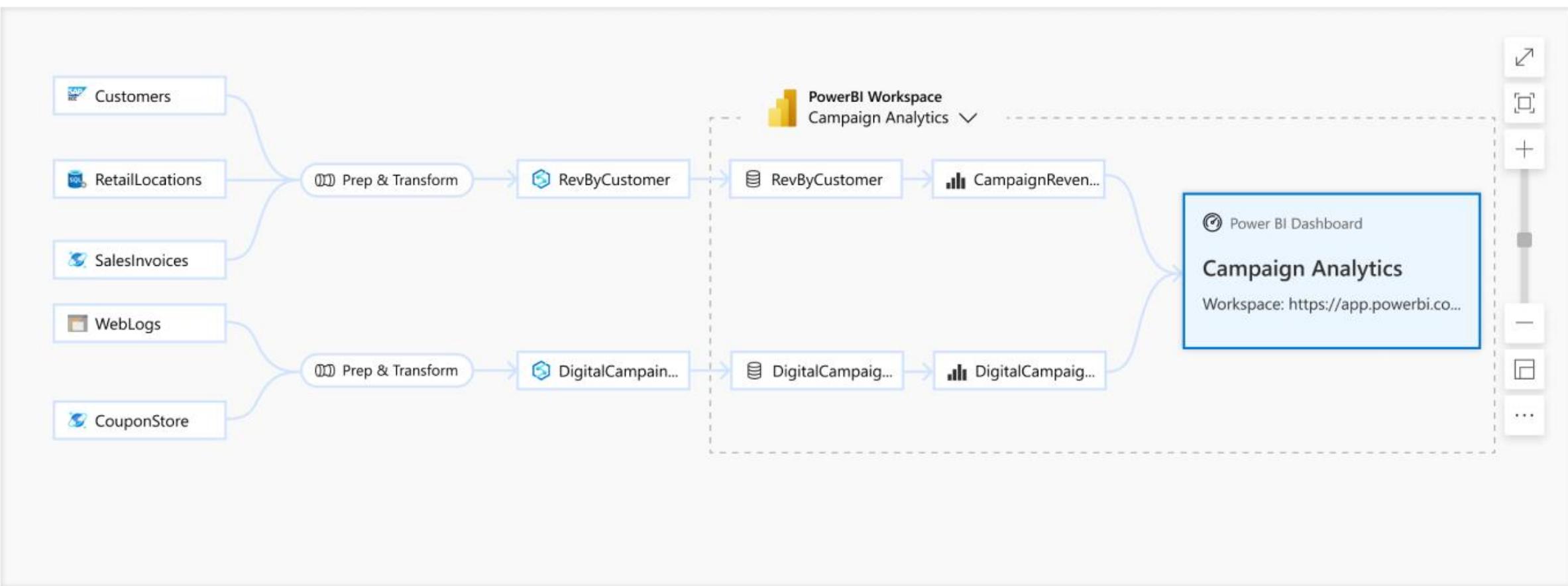
Power BI Dashboard

Edit Refresh

Open in Power BI

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<https://github.com/hfleitas/AzureSynapseForActuaries/blob/main/SolvencyIIUseCase.pdf>

Thank you!

PDF URL

<https://linkedin.com/in/brentcarpenetti>

<https://aka.ms/hiram>

Presenters:

Brent Carpenetti; Senior Actuary, Hannover Re
Hiram Fleitas; Senior Customer Engineer, Microsoft