



MonkeyDWH™

A monkey-proof DWH automation tool
(without a vendor lock)

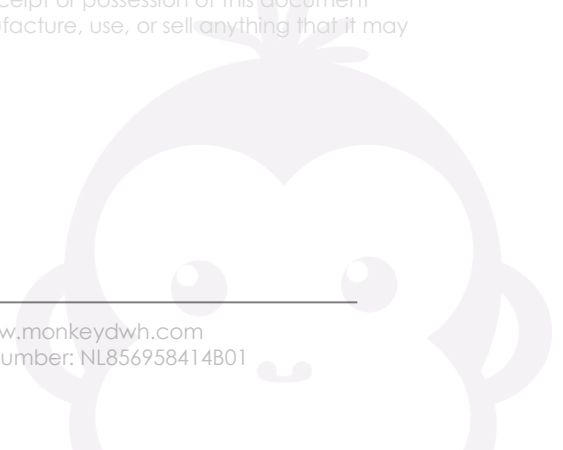
Version 2022-04-21



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1 Introduction & context

With today's tight labor market, every hour spend on development has to count. It can easily take a Data Engineer hours or even days to add additional source tables to a DWH with manual development.

The lack of experienced engineers within a company, or employees leaving a company, raise a risk on any DWH project. Let alone, keeping up with the fast pace of changes within the Azure data landscape, demands discipline and regular training.

2 What is MonkeyDWH™

The MonkeyDWH™ automation tool generates [Azure SQL database](#) and [Azure Data Factory](#) (ADF) objects that enables a company to quickly setup a Data Warehouse (DWH) and Data Mart (DM) on Azure in a matter of days.

With fully implemented [Azure DevOps \(CI&CD\)](#) pipelines, all new code will be build and deployed automatically. And with the [automatic unit testing](#) after each release, it's also able to automatically release a new version to multiple environments (e.g. DEV and PROD), even without manual approvals.

And it's already a proven automation tool, used by multiple clients thus far:

- 2525 Ventures ('LiteBit')
- Opvallers
- WSD Groep
- ITsmart for:
 - o Clear Channel (UK)
- Troovie ('Rockdata') for:
 - o DVJ Insights
 - o ENGIE

3 Benefits of MonkeyDWH™

Future proof

By exclusively using native Azure Data Factory pipelines and activities, and thus without the use of an SSIS Integration Runtime (SSIS-IR), MonkeyDWH™ is easily adaptable to newly added ADF features or (code) changes in the future. MonkeyDWH™ uses Azure's own resource API's, which eliminates any custom PowerShell code or Runbooks to manage resources.

No vendor lock

The MonkeyDWH™ is designed for Microsoft Azure and it generates SQL database- and ADF-objects without any encrypted code. It runs on your own Azure environment, no need for a hosted SaaS-platform.

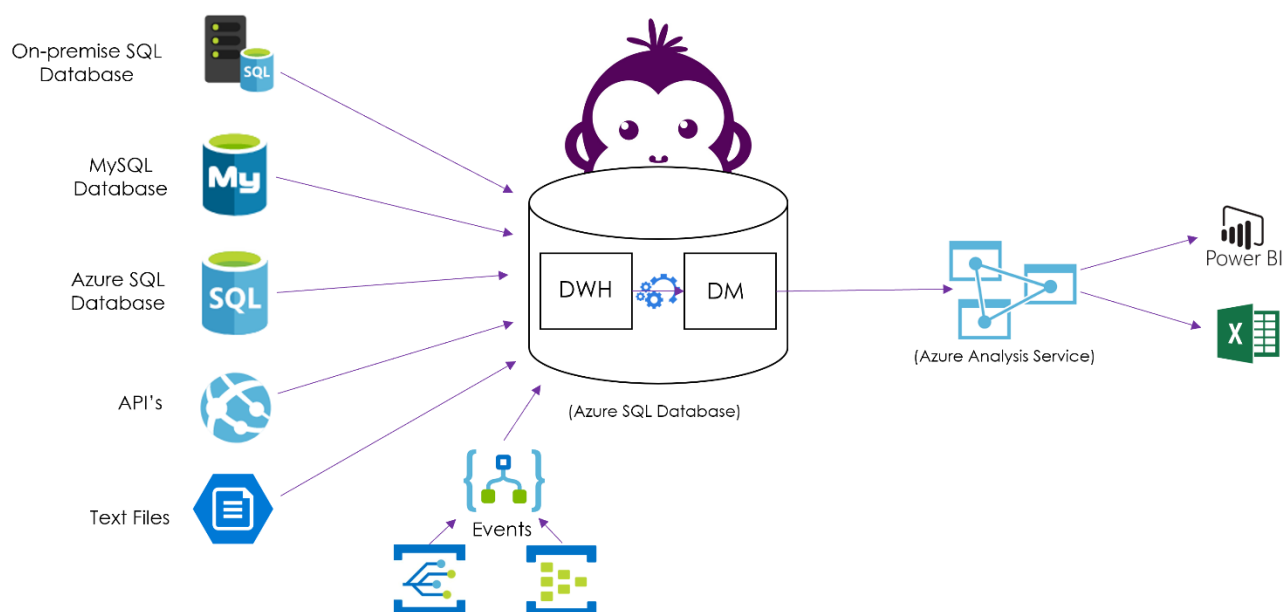
Low runtime costs

Thanks to its architectural design, runtime costs are kept low due to the lack of expensive resources which are billed per month and can't be paused automatically. The DWH and Data Mart (DM) for example, use a single (Serverless) Azure SQL Database for which automatically pauses after an hour. Azure Data Factory (ETL) activities are billed per execution and can be grouped by executions per hour or per day, executing these pipelines only when needed. The costs are even lower thanks to the Azure SQL database instead of the more expensive Azure Synapse Analytics.

Maintenance updates and support

The MonkeyDWH™ will be kept in good shape, thanks to regular maintenance updates. And with the help from technical support, any concerns or issues regarding your DWH will be attended to.

4 A monkey-proof architecture

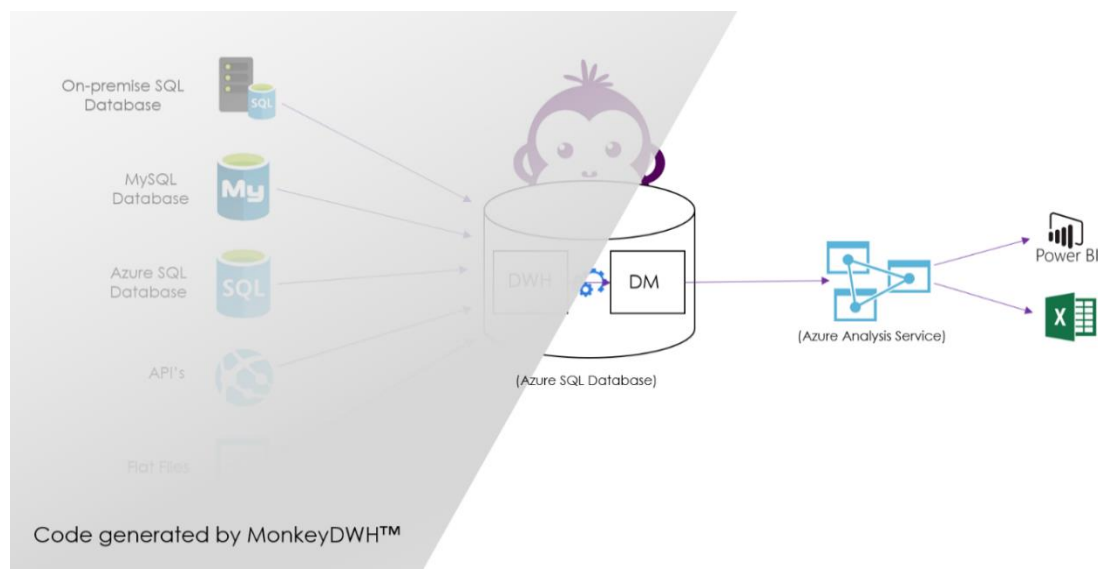


The overall architectural design is seen here, including all supported sources.

Data from different kind of sources is extracted, stored in staging-tables and new changes will be processed by the DWH. The Data Mart contains the dimensional model and will be populated using stored procedures inside the Azure SQL database. After that the Azure Analyses Services Tabular Model will be processed and made available for end-users.

End-users will use Excel PivotTables and Power BI dashboards to analyze the facts, dimensions and KPI's within the Tabular Model. Data Scientists are able to directly query the 'raw' data inside the DWH tables (which are identical to the source tables) or analyze prepared data inside the DM or Tabular Model.

The maximum compressed data volume for the DWH on Business Critical is 4,0TB, but with Hyperscale up to 100TB of storage can be allocated.



The MonkeyDWH™ generates all Azure SQL database- and Data Factory objects needed to extract data from different kind of sources and store data historically inside the DWH. It also generate database tables for the DM and the required ADF pipelines and datasets.

Due to this feature, a Data Engineer doesn't have to spend his/her precious development time on this 'prepping-phase'. He/she is able to fully focus on creating insights, designing an Analysis Service tabular model (also known as a 'cube') and creating Power BI dashboards for the business.

The DWH project would be delivering results (as in usable insights via Power BI dashboards) within a single month, a high ROI with low budgetable costs.

5 Azure Resource Groups

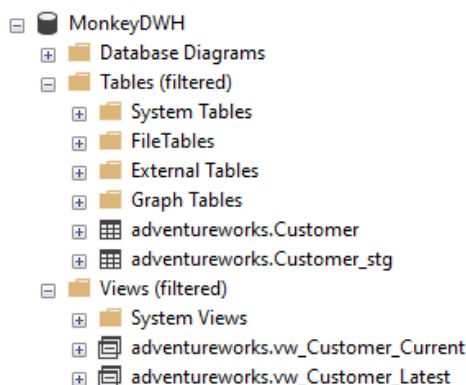
An example of an Azure Resource Group can be seen below. This is how the architecture will look like within the Azure Portal:

Resources	
MonkeyDWH-PROD	
MoveFiles	Logic app
SendEmail	Logic app
MonkeyDWH-PROD-ADF	Data factory (V2)
azurefile	API Connection
monkeydwhprod	SQL server
MonkeyDWH-PROD	SQL database
MonkeyDWH_MetaData	SQL database
CheckForDeletedRecords	Logic app
monkeydwhprodaas	Analysis Services
monkeydwhprodstorage	Storage account
office365-1	API Connection
sql	API Connection

6 Data Warehouse (DWH) objects

A DWH can be seen as sort of a flight recorder, it searches for changes in the data and records it. Each change will be recorded with full history (inserts, updates and optionally also deletes).

Example DWH objects for 'Customer' can be seen here:



The database contains a lot of database objects per source table (such as 'customer'):

- Two tables for each source table
- Two views to (quickly) analyze today's current- or latest -state of the data
- Several logging objects

The generated views provide quick insights on all historical changes. They also include start- and end-dates, and booleans for IsCurrent, IsLatest and IsDeleted as shown below:

Results	Messages	CustomerID	Territory	Group	LOADDATE	FILENAME	STARTDATE	ENDDATE	ISCURRENT	ISLATEST	ISDELETED
1		1	もしもし	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	2019-08-30 14:10:18.109	0	0	0
2		1	Northwest	South Africa	2019-08-30 14:10:18.110	Customer_20190107112233.txt	2019-08-30 14:10:18.110	2019-08-30 14:10:38.592	0	0	0
3		1	Northwest	Europe	2019-08-30 14:10:38.593	Customer_20190108112233.txt	2019-08-30 14:10:38.593	2019-08-30 14:11:37.037	0	1	1
4		2	お元気ですか	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	2019-08-30 14:10:18.109	0	0	0
5		2	Northwest	South Africa	2019-08-30 14:10:18.110	Customer_20190107112233.txt	2019-08-30 14:10:18.110	2019-08-30 14:10:38.592	0	0	0
6		2	Northwest	Europe	2019-08-30 14:10:38.593	Customer_20190108112233.txt	2019-08-30 14:10:38.593	2019-08-30 14:11:37.037	0	1	1
7		3	素敵な過食	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	2019-08-30 14:10:18.109	0	0	0
8		3	Southwest	South Africa	2019-08-30 14:10:18.110	Customer_20190107112233.txt	2019-08-30 14:10:18.110	2019-08-30 14:10:38.592	0	0	0
9		3	Southwest	Europe	2019-08-30 14:10:38.593	Customer_20190108112233.txt	2019-08-30 14:10:38.593	2019-08-30 14:11:37.037	0	1	1
10		4	寿司はおいしいです	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	2019-08-30 14:10:18.109	0	0	0
11		4	Southwest	North America	2019-08-30 14:10:18.110	Customer_20190107112233.txt	2019-08-30 14:10:18.110	9999-12-31 00:00:00.000	1	1	0
12		5	Southwest	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	9999-12-31 00:00:00.000	1	1	0
13		6	Southwest	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	9999-12-31 00:00:00.000	1	1	0
14		7	Northwest	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	9999-12-31 00:00:00.000	1	1	0
15		8	Southeast	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	9999-12-31 00:00:00.000	1	1	0
16		9	Southwest	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	9999-12-31 00:00:00.000	1	1	0
17		10	Canada	North America	2019-08-30 14:09:46.147	Customer_20190106112233.txt	2019-08-30 14:09:46.147	9999-12-31 00:00:00.000	1	1	0

Within the DWH database, two logging tables are available. One for recording all ADF Copy activities while reading and copying data into the staging-tables. Invalid records are skipped by default, but are still recorded in this logging-table (see 'RowsSkipped'):

Results	Messages	LogId	SourceName	ObjectName	Status	StartDateTime	EndDateTime	Duration	RowsRead	RowsCopied	RowsSkipped	FileName
1		11	AdventureWorks	SalesOrderHeader	Succeeded	2019-08-30 14:24:22.3...	2019-08-30 14:24:53....	00:00:31	31465	31465	0	SalesOrderHeader_20190106112233.txt
2		10	AdventureWorks	SalesOrderDetail	Succeeded	2019-08-30 14:13:59.2...	2019-08-30 14:16:29....	00:02:30	121317	121317	0	SalesOrderDetail_20190106112233.txt
3		9	Star Wars	Planets	Succeeded	2019-08-30 14:13:12.1...	2019-08-30 14:13:21....	00:00:09	61	61	0	Planets_20190820112233.csv
4		8	AdventureWorks	Product	Succeeded	2019-08-30 14:12:36.3...	2019-08-30 14:12:44....	00:00:08	504	504	0	Product_20190106112233.txt
5		7	AdventureWorks	Customer	Succeeded	2019-08-30 14:10:48.0...	2019-08-30 14:10:55....	00:00:07	1328	1328	0	Customer_20190116112233.txt
6		6	AdventureWorks	Customer	Succeeded	2019-08-30 14:10:26.2...	2019-08-30 14:10:35....	00:00:09	1334	1334	0	Customer_20190108112233.txt
7		5	AdventureWorks	Customer	Succeeded	2019-08-30 14:10:04.9...	2019-08-30 14:10:11....	00:00:07	1334	1334	0	Customer_20190107112233.txt
8		4	AdventureWorks	Customer	Succeeded	2019-08-30 14:09:34.4...	2019-08-30 14:09:40....	00:00:06	1334	1334	0	Customer_20190106112233.txt
9		3	Star Wars	People	Succeeded with rows skipped	2019-08-30 14:07:53.6...	2019-08-30 14:07:59....	00:00:06	87	83	4	People_20190820112233.csv
10		2	AdventureWorks	Customer	Failed	2019-08-30 14:06:39.1...	2019-08-30 14:06:45....	00:00:06	0	0	0	Customer_20190106235999.txt
11		1	Star Wars	Movies	Succeeded with rows skipped	2019-08-30 14:06:29.1...	2019-08-30 14:06:38....	00:00:09	15	7	8	Movies_20190820112233.csv

Failed ADF Copy activities are also recorded properly:

Results Messages										
	LogId	SourceName	ObjectName	Status	Duration	RowsRead	RowsCopied	RowsSkipped	FileName	ErrorMessage
1	14	AdventureWorks	Customer	Failed	00:00:07	0	0	0	Customer_20190106235999.txt	ErrorCode=UserErrorInvalidColumnMappingColumnNotFound,

The other logging-table records the output from each 'processing stored procedure'. Each insert, update and delete is properly recorded:

Results Messages												
	LogId	SourceName	ObjectName	Status	FileName	StartDateTime	EndDateTime	Duration	NumberOfInserts	NumberOfUpdates	NumberOfDeletes	
1	12	AdventureWorks	SpecialOffer	Success	SpecialOffer_20190107112233.csv	2019-08-30 14:28:55.263	2019-08-30 14:28:55.263	00:00:00	0	1	0	
2	11	AdventureWorks	SpecialOffer	Success	SpecialOffer_20190106112233.txt	2019-08-30 14:28:55.263	2019-08-30 14:28:55.263	00:00:00	16	0	0	
3	10	AdventureWorks	SalesOrderHeader	Success	SalesOrderHeader_20190106112233.txt	2019-08-30 14:26:48.170	2019-08-30 14:27:14.170	00:00:26	31465	0	0	
4	9	AdventureWorks	SalesOrderDetail	Success	SalesOrderDetail_20190106112233.txt	2019-08-30 14:21:38.273	2019-08-30 14:23:23.273	00:01:45	121317	0	0	
5	8	Star Wars	Planets	Success	Planets_20190820112233.csv	2019-08-30 14:13:34.960	2019-08-30 14:13:35.960	00:00:01	61	0	0	
6	7	AdventureWorks	Product	Success	Product_20190106112233.txt	2019-08-30 14:13:00.793	2019-08-30 14:13:00.793	00:00:00	504	0	0	
7	6	AdventureWorks	Customer	Success	Customer_20190116112233.txt	2019-08-30 14:11:37.037	2019-08-30 14:11:46.037	00:00:09	0	0	6	
8	5	AdventureWorks	Customer	Success	Customer_20190108112233.txt	2019-08-30 14:11:37.037	2019-08-30 14:11:43.037	00:00:06	0	3	0	
9	4	AdventureWorks	Customer	Success	Customer_20190107112233.txt	2019-08-30 14:11:37.037	2019-08-30 14:11:41.037	00:00:04	0	4	0	
10	3	AdventureWorks	Customer	Success	Customer_20190106112233.txt	2019-08-30 14:11:37.037	2019-08-30 14:11:39.037	00:00:02	1334	0	0	
11	2	Star Wars	People	Success	People_20190820112233.csv	2019-08-30 14:08:22.767	2019-08-30 14:08:23.767	00:00:01	83	0	0	
12	1	Star Wars	Movies	Success	Movies_20190820112233.csv	2019-08-30 14:06:52.743	2019-08-30 14:06:52.743	00:00:00	7	0	0	

7 Data Mart (DM) objects

The DM objects will look like this:

MonkeyDM
Tables
adventureworkstm.DIM_Calendar
adventureworkstm.DIM_Customer
adventureworkstm.DIM_SalesOrder
adventureworkstm.FACT_SalesOrders
logging.CopyActivityLog
Programmability
Stored Procedures
System Stored Procedures
logging.usp_InsertLogging

The logging-table inside the DM database records all ADF Copy activities while populating the Data Mart. Invalid records are skipped, but recorded in this logging-table (see 'RowsSkipped'):

Results Messages										
	LogId	SourceName	ObjectName	Status	StartDateTime	EndDateTime	Duration	RowsRead	RowsCopied	RowsSkipped
1	4	AdventureWorksTM	FACT_SalesOrders	Succeeded	2019-08-30 14:37:14.4466667	2019-08-30 14:40:35.4466667	00:03:21	31465	31465	0
2	3	AdventureWorksTM	DIM_SalesOrder	Succeeded	2019-08-30 14:36:16.2100000	2019-08-30 14:36:59.2100000	00:00:43	31465	31465	0
3	2	AdventureWorksTM	DIM_Customer	Succeeded	2019-08-30 14:35:51.3633333	2019-08-30 14:35:59.3633333	00:00:08	1341	1341	0
4	1	AdventureWorksTM	DIM_Calendar	Succeeded	2019-08-30 14:32:21.4700000	2019-08-30 14:35:33.4700000	00:03:12	10959	10959	0

8 Azure Data Factory

Azure Data Factory (ADF) is responsible for copying and processing all data in the Azure architecture.

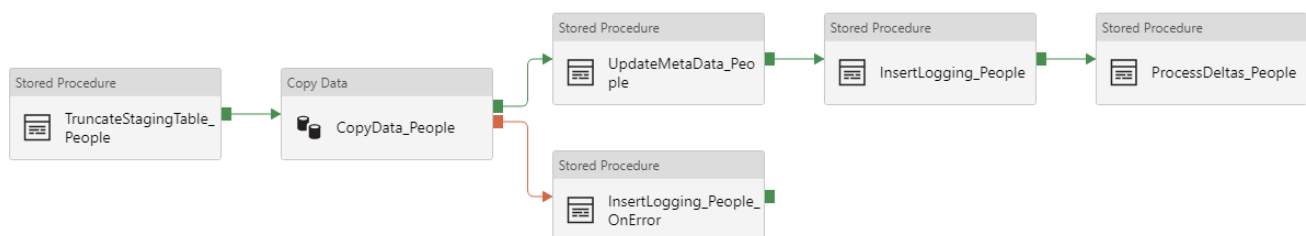
Over 80+ different types of so called 'connectors' are natively supported by ADF, but in most cases, only a handful are used. MonkeyDWH™ supports CSV-files, JSON-files, API's, Azure SQL databases, on-premise SQL databases and MySQL databases. Other types of sources can be added on request.

In the screenshot below, pipelines for DWH are generated for three different sample databases, namely PerformanceTest, Star Wars and WideWorldImporters. Pipelines for the AdventureWorks flat files (both CSV and TXT combined) are also included. The Data Mart (DM) contains a Fact and three Dimensions, all based upon four stored procedures as a source:

Factory Resources	
<input type="text" value="Filter resources by name"/>	
Pipelines 59	
<ul style="list-style-type: none"> Daily Run Daily Start Daily Stop Maintenance Process Analysis Services Resume Analysis Services Scale Down Database Scale Up Database Suspend Analysis Services 	
Data Mart 8	
<ul style="list-style-type: none"> DM AdventureWorksTM 7 	
Data Warehouse 39	
<ul style="list-style-type: none"> DWH AdventureWorks 6 OpenData 6 Star Wars 4 WideWorldImporters 22 Export 3 	
Datasets 95	
<ul style="list-style-type: none"> Data Mart 8 Data Warehouse 73 Export 14 	

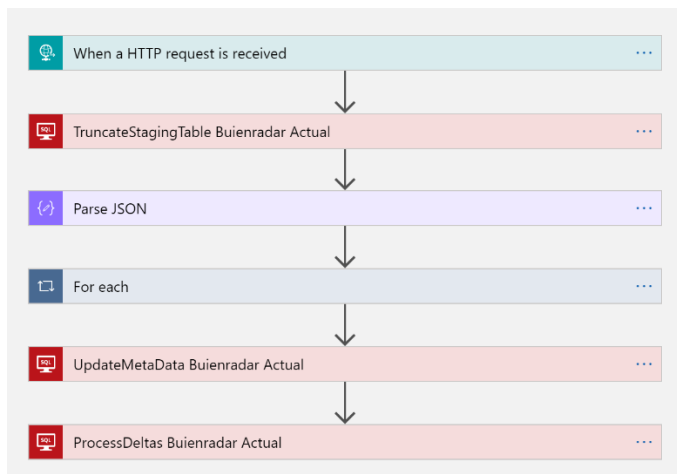
Database as a source

In comparison, the pipeline below shows the required activities to pull data out of a source database and process it properly in the DWH:



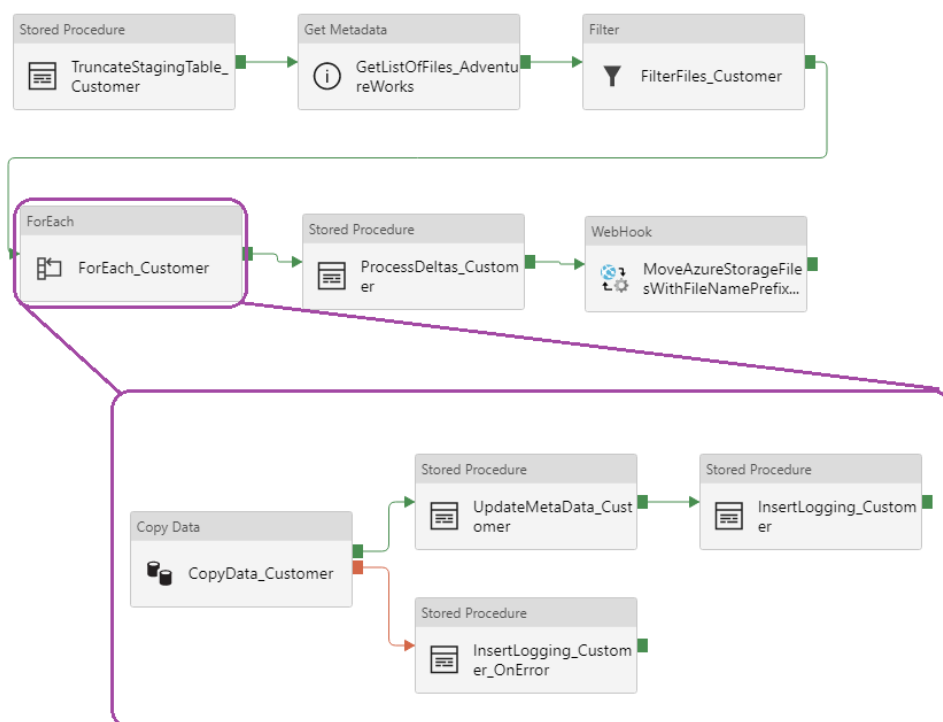
Event as a source

Event-driven architectures are becoming more and more mainstream, and processing such events within the Azure landscape, is also supported by the MonkeyDWH™. Events sent by for example an Event Hub, Webhook or Event Grid Topic, will be handled by customized Logic Apps:



Flat File as a source

An inside view of an ADF pipeline can be seen below. This pipeline consists of only native ADF activities and processes flat files:



9 Benchmark

The DWH has four processing methods (configurable per source table), namely:

- Bulk Import
- Inserts Only
- Inserts & Updates
- Inserts, Updates & Deletes

During this benchmark, a total of **44 million records** were ingested from an Azure SQL database on a different SQL Server and Resource Group. Eight ADF pipelines ran in parallel, copying the data from the source to the sink tables and processing the data depending on the different methods. It took no more than **28 minutes and 55 seconds**:

	1 million records		10 million records	
	Processing time	Total duration	Processing time	Total duration
Bulk Import	01:02	02:10	14:31	26:21
Inserts Only	00:59	02:15	12:33	24:25
Inserts & Updates	01:00	02:09	12:39	23:34
Inserts, Updates & Deletes	01:11	02:21	16:31	28:55

(Running in parallel on Gen5 - General Purpose - GP_S_Gen5_4)

10 Azure DevOps (CI/CD) with automatic unit testing

The MonkeyDWH™ will be configured using Azure DevOps with Continuous Integration, Continuous Delivery or Continuous Deployment (CI/CD). Thanks to our automatic unit testing, we're able to implement Continuous Deployment to a Production-environment as seen below.

Azure DevOps Release Pipeline, including a stage for unit tests on the Development-environment:

MonkeyDWH-Release > MonkeyDWH-Build_master_2020.10.27... ▾

Pipeline Variables History | + Deploy ▾ | Cancel | Refresh | Edit ▾ | ...

Release

Continuous deployment
for Microsoft.VisualStudio...
10/27/2020, 5:04 PM

Artifacts

MonkeyDWH-Build
MonkeyDWH-
Build_master_2020.10.27.1
master

Stages

DEV

✓ Succeeded

on 10/27/2020, 5:13 PM

Testing DEV

✓ Succeeded

on 10/27/2020, 10:46 PM

100%

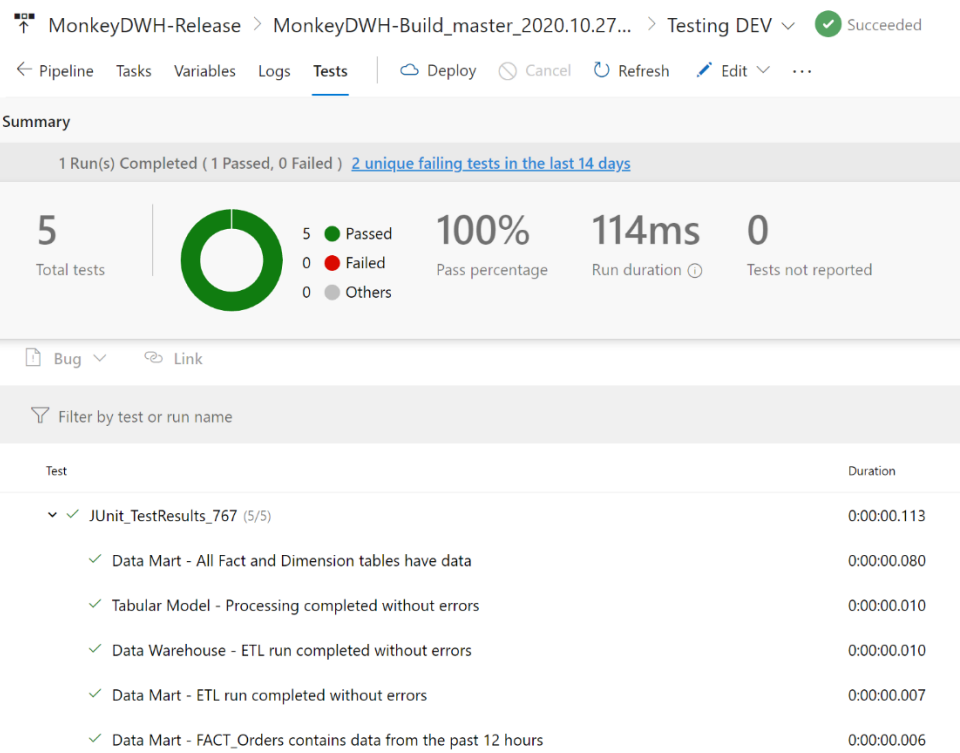
PROD

✓ Succeeded

on 10/27/2020, 11:11 PM

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The results of the unit tests:



11 Tooling

Designing a future-proof and cloud native automation tool, means depending solely on T-SQL coding and meta-data, to generate all database- and ADF-objects.

Here's an overview of all tools:



About these tools:

- **SQL Server** is used locally for hosting the model database (for DWH and DM)
- **Visual Studio** will contain both database projects and also a project for the **Analysis Services** Tabular Model. This in combination with **Git** for code versioning
- **Azure DevOps** is used for building and releasing new code automatically (CI&CD)

12 License

The MonkeyDWH comes with a single license, namely:

MonkeyDWH™ perpetual license

This perpetual license for the MonkeyDWH™ allows the licensee to use the MonkeyDWH™ framework, coding, meta-data database and all the generated Azure Data Factory and SQL Database objects within their Azure and Azure DevOps environment. Technical updates are included for minor changes in the coding and/or new features.

13 Pricing

About the amount of peanuts...

License:

- | | |
|---|---|
| - MonkeyDWH™ perpetual license | € 24.995,- (ca. € 521,- per month over 4 years) |
| - Azure DevOps CI&CD + Automatic Unit Testing | € 4.995,- |

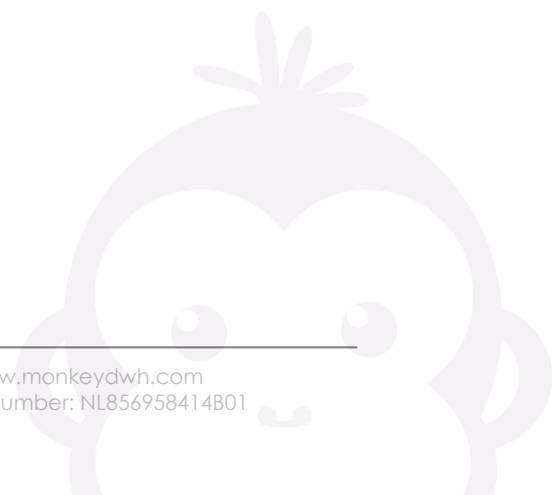
Monthly costs:

- | | |
|------------------------------------|--|
| - Azure running costs (PROD & DEV) | Starting from € 400,- up to € 1.400,- per month* |
|------------------------------------|--|

Additional consultancy services:

- Support subscriptions
- Azure & DevOps training courses and workshops

* This estimation is based on two environments (DEV & PROD) with 5 GB up to 50 GB of compressed data in the DWH, a daily load between 1 GB and 5 GB and an Azure Analysis Service Tabular Model on PROD scaled at Standard S0.



14 Planning

Within a week, the new Azure & DevOps architecture is fully configured with sample data(bases):

Week 1:

- Setting up and configuring Azure
- Implementing Azure DevOps Build- and Release-pipelines for CI&CD
- Adding the first source to the MonkeyDWH™

Week 2:

- Adding additional sources to the MonkeyDWH™

Week 3:

- Creating the first Facts and Dimensions for the Dimensional Model (DataMart) and cube

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Initial setup of Azure & DevOps															
Adding Source #1															
Adding Source #2															
Adding Source #3															
Adding Source #4															
Creating the first Fact's and Dim's															
Training internal employees															

Knowledge and Skill Requirements:

Minimum set of skills to operate: common BI/DWH knowledge

(e.g. DWH, SCD, Dimensional modelling, Business Keys, T-SQL and Hashes)

15 Our proud customers

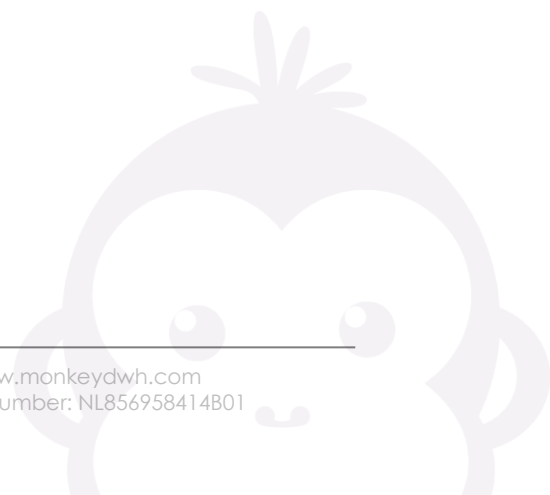
Our proud customers use MonkeyDWH either for their own environment or

Our proud customers use the MonkeyDWH™ automation tool to generate [Azure SQL database](#) and [Azure Data Factory](#) (ADF) objects for their Data Warehouse (DWH) and Data Marts (DM) on Azure. While others use it to develop data landscapes their customers (white label).

rock_data



opvallers[®]
rumour around the brand



16 Questions & Answers

Q) Why use an Azure SQL database instead of Azure Synapse Analytics on Azure?

A) Most of our customers have far less than 500GB of compressed data. An Azure SQL database is ideal for these type of volumes, when considering all supported database features and low runtime costs. Azure Synapse Analytics is more practical when dealing with at least 2,0TB of compressed data¹.

Q) When our compressed data volume exceeds 2,0TB, are we able to switch to Synapse Analytics instead?

A) Yes, but the current version of the MonkeyDWH™ automation tool doesn't natively support Azure Synapse Analytics. Different objects (especially indexes, partitions and queries) will need to be generated. An important fact is that the maximum compressed data volume for the DWH on Business Critical is 4,0TB, but with Hyperscale up to 100TB of storage can be allocated.

Q) Are we able to export data from the DWH to flat files?

A) Yes, the MonkeyDWH™ automation tool has an export functionality, which extracts data from various database source types (e.g. Azure SQL-, On-premise SQL- and MySQL- databases) and is able to export this data to flat files with different text formats. This functionality can be easily configured, for example to export data from the DWH to an Azure File Storage (SMB) or Data Lake.

Q) Is it possible to include a Data Lake in the architecture?

A) Yes, with use of the export functionality (mentioned above), you're able to export data directly to a Data Lake. Importing data from Azure Data Lake Storage is possible with minimal custom development using Azure Data Factory Data Flows for example.

Q) Does the MonkeyDWH™ automation tool support the generation of a Data Vault 2.0 model?

A) No, not by default, but this would be possible with custom development.

Q) Where are all business- and transformation-rules located within the DWH?

A) All ADF pipelines use Copy Data activities to execute stored procedures and move data. Business- and transformation-rules (logic) is maintained within the DM stored procedures (and thus queries).

Q) Is it possible to add an additional source type?

A) Yes, this is very much possible with minimal custom development. All 80+ ADF connectors can be used to connect to various sources, like MySQL, Netezza, Oracle, SAP, Snowflake, MongoDB and more.

¹ For more info, please visit: <https://stackify.com/azure-sql-database-vs-warehouse/> and <https://www.blue-granite.com/blog/is-azure-sql-data-warehouse-a-good-fit-updated/> and <https://www.wardyit.com/blog/azure-synapse-or-azure-sql-database-which-one-to-consider-for-data-warehouse/>

17 About Monkey Consultancy B.V.

<http://www.monkeyconsultancy.nl/>

Monkey Consultancy is specialized in designing, generating and managing Data Warehouse (DWH) architectures on Azure. Especially combining these new architectures with Azure DevOps for being able to automatically build and release new versions of code. All Azure environments, combined with fully operational Azure DevOps (CI&CD) processes will be handed over to new customers in just a few weeks.

Over the past few years, we've shared our passion via the Monkey Update, a monthly newsletters about SQL Server, Microsoft BI, Azure, Azure DevOps and Power BI. Currently having 295 opt-in subscribers, a proud achievement.

With over 13 years of experience within the Microsoft BI competence, we've done business with:



18 Contact information

Questions or interested in a live demo?
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