

Using Lakehouse data at scale with Power BI. Featuring Power BI Direct Lake mode!

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Slides





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dataMinds



sessionize



Fabric CAT

.be Member

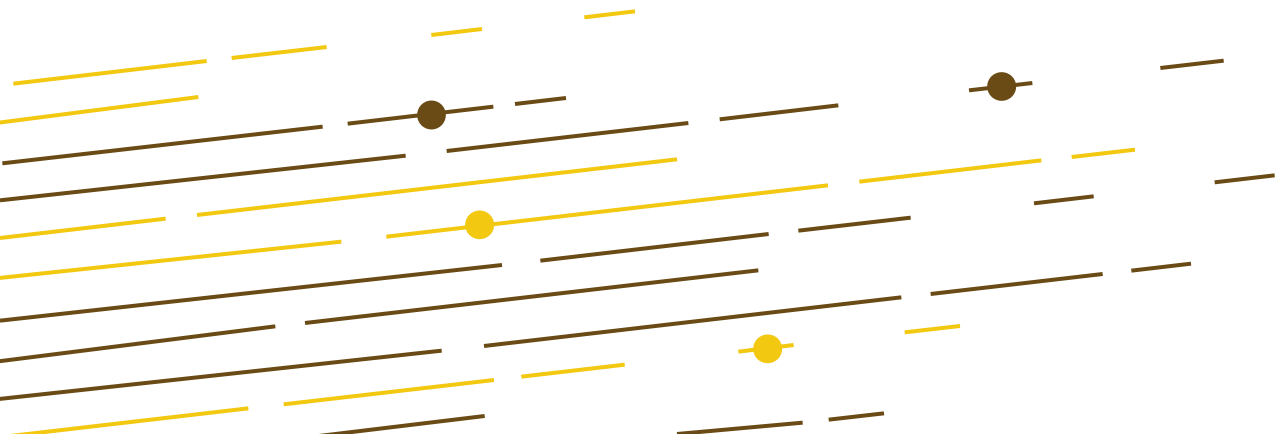
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Session Objectives



Session Objectives

- Introduce Fabric and OneLake
- Set the scene for Direct Lake
- Take it for spin.. 😊

Introducing Fabric



Microsoft Fabric



**Data
Factory**



**Real-Time
Intelligence**



Databases



Analytics



**Industry
Solutions**



Power BI



**Partner
solutions**



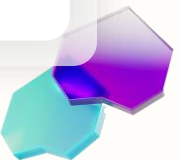
Copilot in Fabric



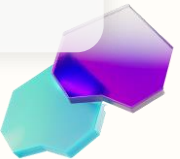
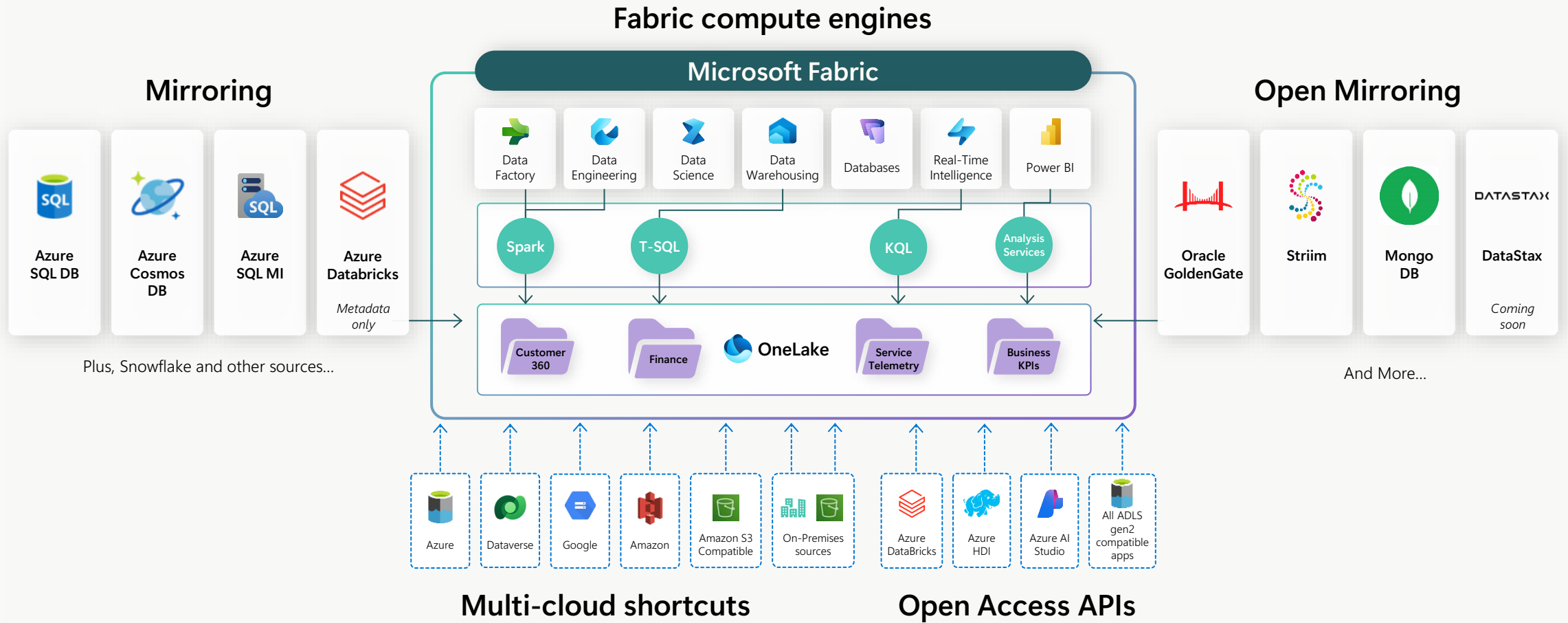
OneLake



Microsoft Purview



Bring in data from anywhere

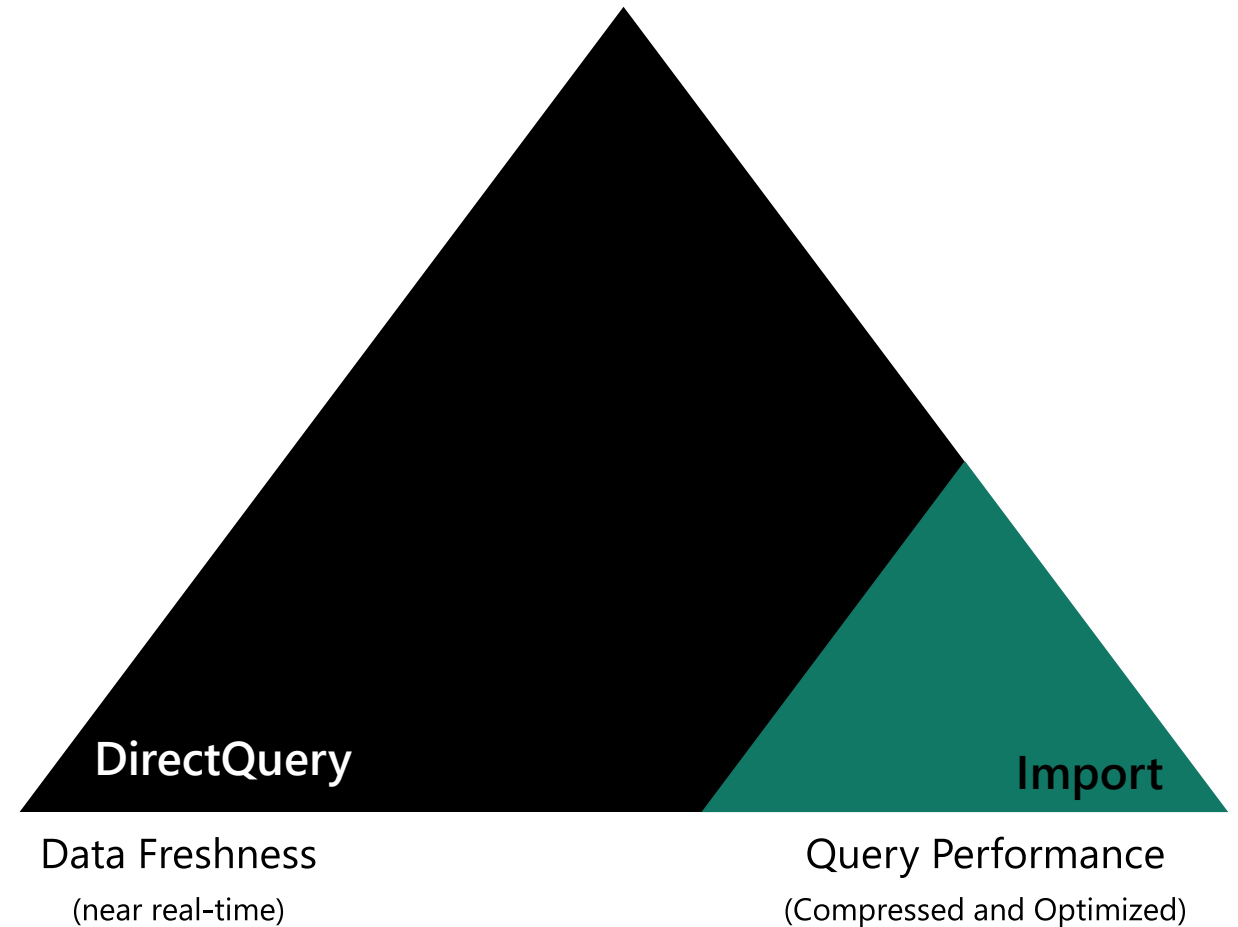


Storage Modes

Import: Caches data into memory to deliver extremely fast performance using the **analysis services** database engine. The default mode when creating a new Power BI Desktop solution along with providing Data Modelers the most design flexibility.

DirectQuery: Does not import the data into memory, consists only of the metadata defining the structure. When the model is queried, native queries are used to retrieve data from the underlying data source.

Changing the **Storage mode** of a table to **Import** is an irreversible operation. Once set, this property can't later be changed using Power BI Desktop.



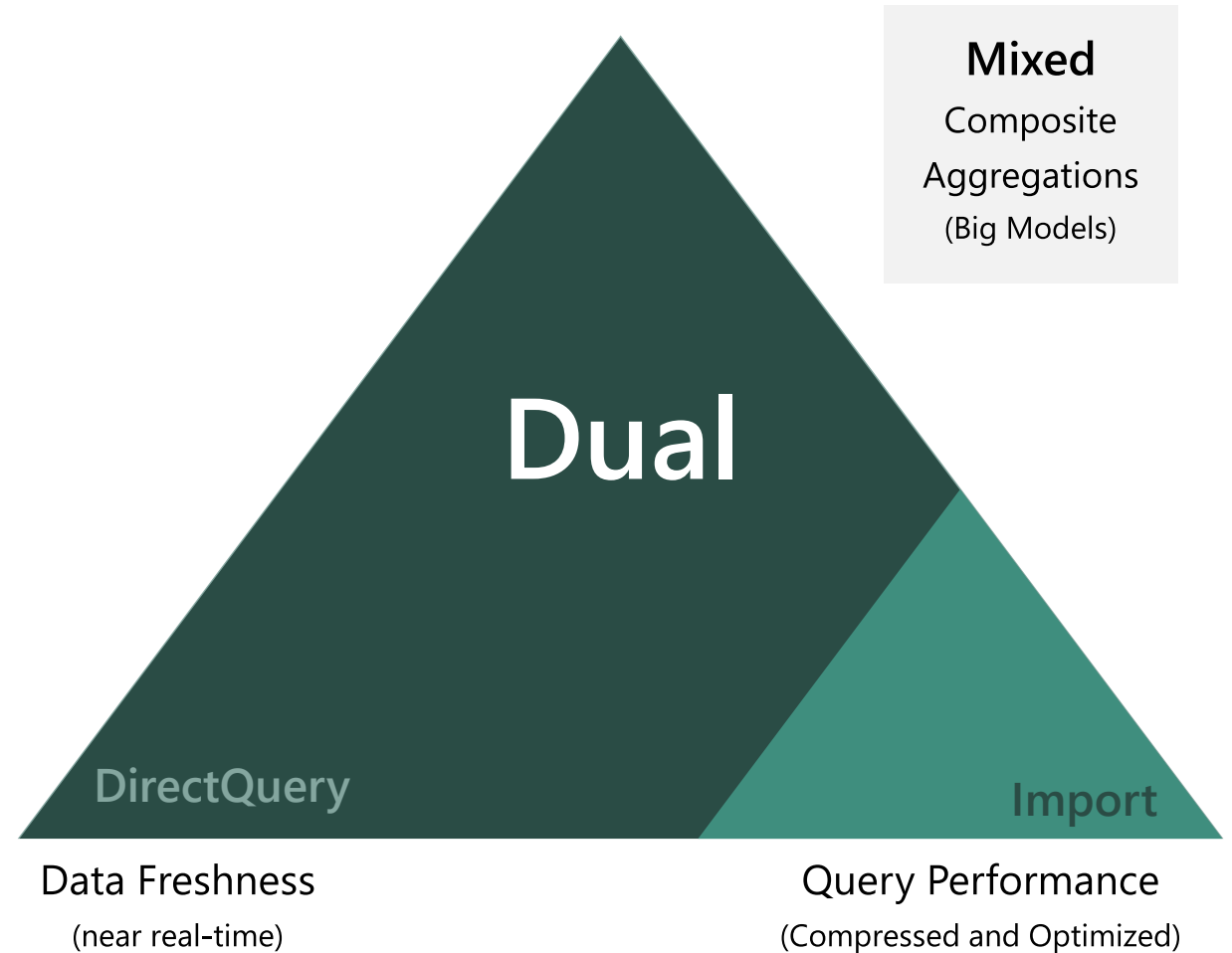
Storage Modes

Import: Caches data into memory to deliver extremely fast performance using the **analysis services** database engine. The default mode when creating a new Power BI Desktop solution along with providing Data Modelers the most design flexibility.

DirectQuery: Does not import the data into memory, consists only of the metadata defining the structure. When the model is queried, native queries are used to retrieve data from the underlying data source.

Dual: Can act as either cached or not cached, depending on the context of the query that's submitted to the Power BI dataset. In some cases, you fulfill queries from cached data. In other cases, you fulfill queries by executing an on-demand query to the underlying data source.

Changing the **Storage mode** of a table to **Import** is an irreversible operation. Once set, this property can't later be changed to either **DirectQuery** or **Dual** using Power BI Desktop.



Storage Modes

Direct Lake: A groundbreaking new dataset capability for analyzing very large data volumes. Based on loading parquet-formatted files directly from a data lake **without having to query a Lakehouse endpoint**, and **without having to import or duplicate data** into a Power BI dataset. Direct Lake is a fast-path to load the data from the lake straight into the Power BI engine, ready for analysis and yielding performance similar to import mode.

DirectQuery (fallback): Automatically switches modes—either due to current limitations or based on factors such as available memory in the capacity.

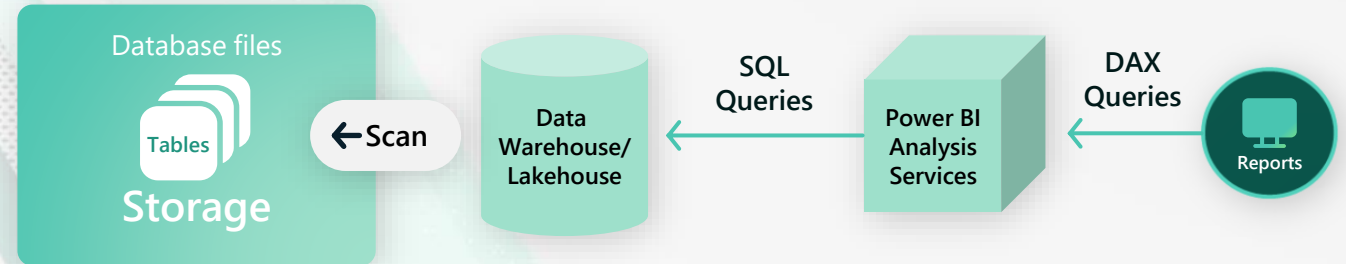


Power BI | Direct Lake Mode

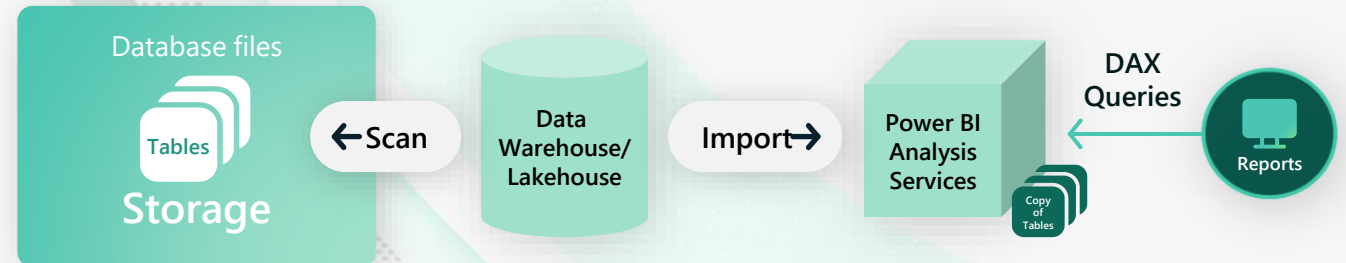
Direct Lake is a fast-path to load the data from the lake straight into the Power BI engine, ready for analysis

Direct Lake is based on loading parquet-formatted files directly from a data lake without having to query a Lakehouse endpoint, and without having to import or duplicate data into a Power BI dataset

DirectQuery Mode. Slower, but real time



Import Mode. Fast, but latent and duplicative



Direct Lake Mode. Fast and 'real time'



Why Delta?



Why Delta (Parquet)?

Becoming the Industry Standard

Open Standard for file format


Column oriented, efficient data storage and retrieval

Efficient Data Compression and Encoding

Well suited for pruning (Column, rowgroup)

Thrives on bulk operations

What is Parquet



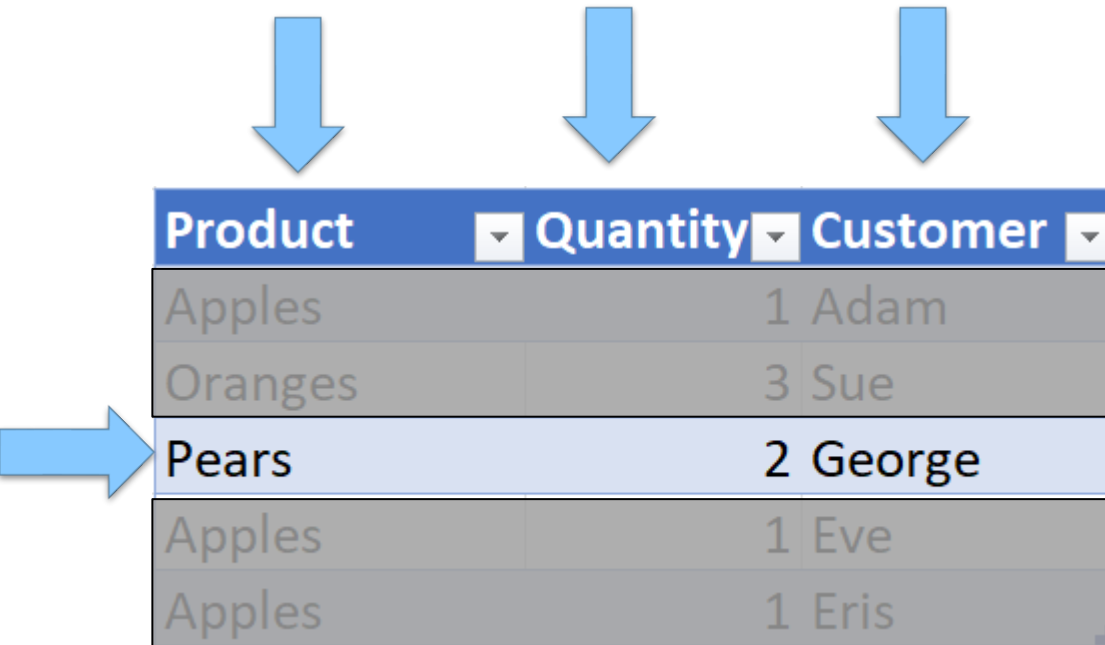
Product	Quantity	Customer
Apples	1	Adam
Oranges	3	Sue
Pears	2	George
Apples	1	Eve
Apples	1	Eris

A columnar format...

Great for this

```
SELECT SUM(Quantity)
GROUP BY Customer
```

What is Parquet



Product	Quantity	Customer
Apples	1	Adam
Oranges	3	Sue
Pears	2	George
Apples	1	Eve
Apples	1	Eris

A columnar format...

Not so great for this:

```
UPDATE (Product, Quantity)
WHERE Customer='George'
```

What is Parquet



Product	Quantity	Customer
Apples	(6)	1 Adam
Oranges	(7)	3 Sue
Pears	(5)	2 George
Apples	(6)	1 Eve
Apples	(6)	1 Eris

Product Size = 30 characters (bytes)

..., dictionary encoded, ...

Let

Apples = 1

Oranges = 2

Pears = 3

What is Parquet



Product	Quantity	Customer
1	1	Adam
2	3	Sue
3	2	George
1	1	Eve
1	1	Eris

Product Size = 5x4 bytes = 20 bytes

..., dictionary encoded, ...

Let

Apples = 1

Oranges = 2

Pears = 3

What is Parquet



Product	Quantity	Customer
0b01	1	Adam
0b10	3	Sue
0b11	2	George
0b01	1	Eve
0b01	1	Eris

Product Size = 5x2 bits = 10 bits ~ 2 bytes

That's 15x smaller!

..., dictionary encoded, ...

2 bits are enough for 3 values!!! - BITPACKING

Let

Apples = 1 = 0b01

Oranges = 2 = 0b10

Pears = 3 = 0b11

What is Parquet

..., with RLE compression

RLE - Run-length encoding

(replace repeated occurrences
with the count)

Product	Quantity	Customer
Apples	1	Adam
Oranges	3	Sue
Pears	2	George
Apples	1	Eve
Apples	1	Eris

Introducing V-Ordering

Write time optimization to parquet files

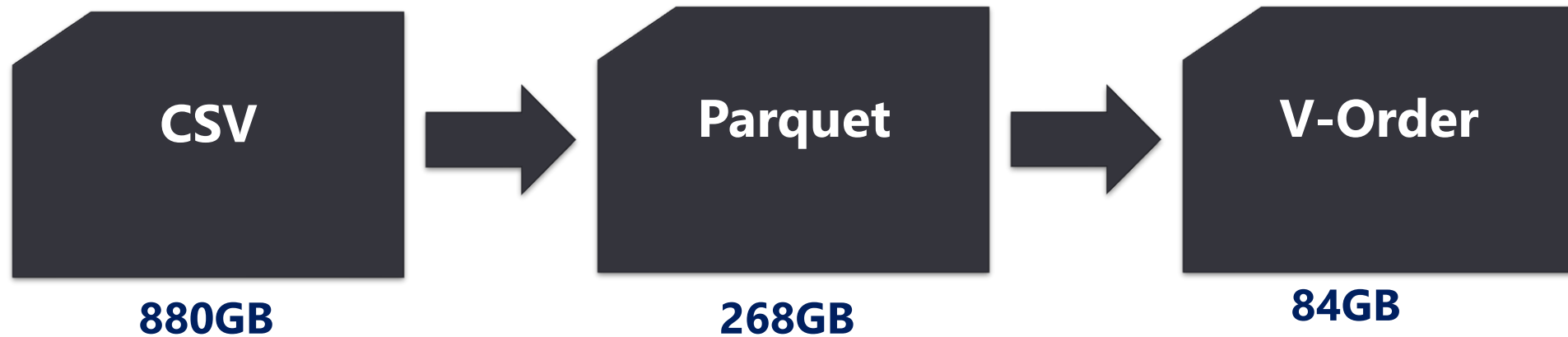
Sorting, row group distribution, dictionary encoding, and compression (Shuffling)

Complies to the open standard

Z-Order, compaction, vacuum, time travel, etc. are compatible with V-Order

V-ordering in action

Microsoft Internal DB (162 tables)



x3.2

Reduced IO for workloads

V-ordering in our demo case

CSV Properties

General

Sharing

Security

Previous Versions

Customise

CSV

Type: File folder

Location: C:\OneDrive\OneDrive - dataMinds vzw\Documents\IF

Size: 32.1 GB (34,544,780,233 bytes)

Size on disk: 32.1 GB (34,545,246,208 bytes)

Contains: 242 Files, 7 Folders

	TABLE_NAME	SCHEMA_NAME	Rows	TotalReservedSpaceMB	UsedDataSpaceMB	FreeUnusedSpaceMB
1	Trips_FA	Analytical	181940575	6413	6412	0
2	Time_DI	Analytical	86400	15	15	15
3	Bike_DI	Analytical	35553	1	1	1
4	Date_DI	Analytical	7304	19	19	19
5	Date_DI	Analytical	7304	0	0	0
6	Station_DI	Analytical	3430	0	0	0
7	Gender_DI	Analytical	59	0	0	0
8	Region_DI	Analytical	8	0	0	0
9	RideType_DI	Analytical	4	0	0	0
10	UserType_DI	Analytical	3	0	0	0
11	TripType_DI	Analytical	3	0	0	0
12	MemberType_DI	Analytical	3	0	0	0
13	FileType_DI	Analytical	3	0	0	0

	Name	Date modified	Type	Size
	4b7c39a4-613d-445a-9533-e4c2a08ab671.parquet	6/5/2023 4:00:58 PM	PARQUET	5.50 GB
	_delta_log	6/5/2023 4:00:58 PM	Folder	1 items

Copy data details

Copy_mns

Source

Azure SQL Database

→

Destination

Lakehouse

Data read: ⓘ

24.016 GB

Data written: ⓘ

5.909 GB

Rows read:

181,940,575

Files written: ⓘ

1

Rows written: ⓘ

181,940,575

Status

✔ Succeeded

Start time

6/5/2023, 3:22:03 PM

Pipeline run activity ID

09aa4ccc-d8ae-4e70-aec7-c76a020ddd3c

Throughput

10.321 MB/s

Total duration

00:38:53

Duration breakdown

Start time

6/5/2023, 3:22:04 PM

Optimized throughput ⓘ

Standard

Used parallel copies ⓘ

1



	Date modified	Type	Size
	4b7c39a4-613d-445a-9533-e4c2a08ab671.parquet	PARQUET	5.50 GB
	_delta_log	Folder	1 items

What is Direct Lake Mode?

DirectLake Mode

- On start, no data is loaded in memory
- Column data is transcoded from Parquet files when queried
- Tables can have mix of resident and non-resident columns
- Column data can get evicted over time
- DirectLake fallback as an alternative
- "Framing" of dataset determines what gets loaded from Delta Lake

STOP! Demo time!

Using Direct Lake mode over a Lakehouse

Fallback to DirectQuery & Framing

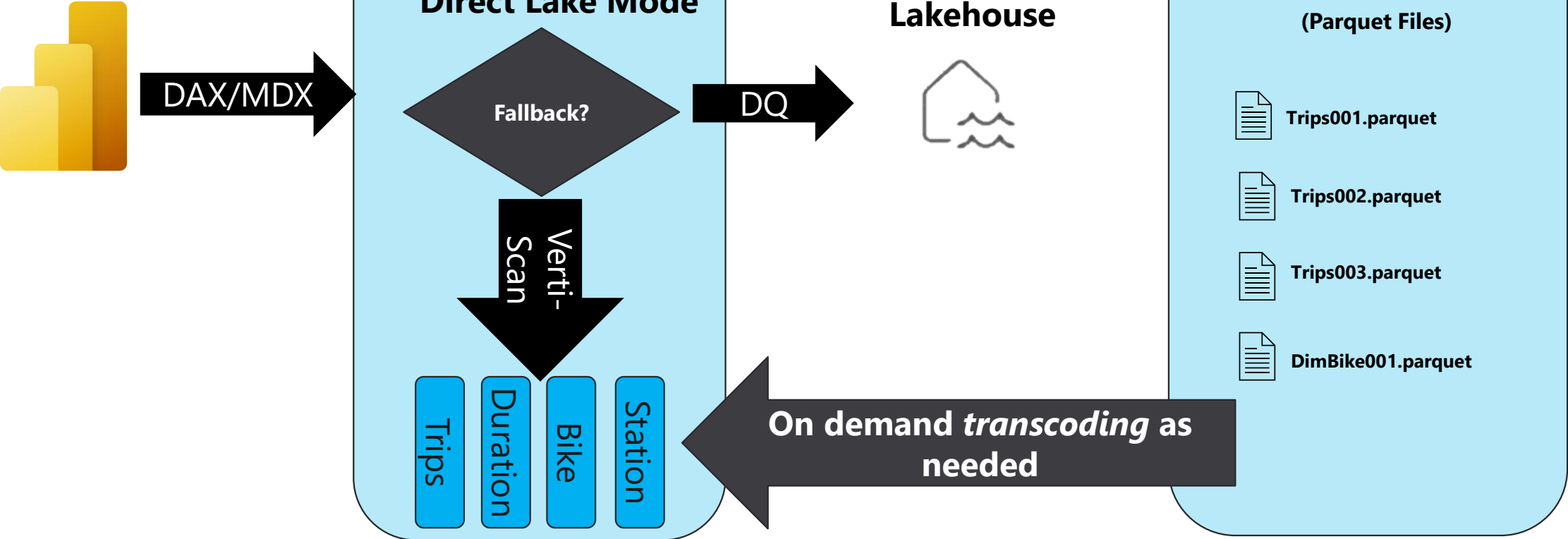
Framing

- What is framing
 - "point in time" way of tracking what data can be queried by DirectLake
- Framing is near instant and acts like a cursor
 - Determines the set of .parquet files to use/ignore for *transcoding* operations
- Why is this important
 - Delta-lake data is transient for many reasons
- Typical ETL Process
 - Ingest data to delta lake tables
 - Transform as needed using preferred tool
 - When ready, perform *Framing* operation on dataset

STOP! Demo time!

Let's look at Framing

DQ Fallback



STOP! Demo time!

Let's look at Fallback

Guardrails

Fabric/Power BI SKUs	<u>Parquet</u> files per table	Row groups per table	Rows per table (millions)	Max model size on disk/OneLake1 (GB)	Max memory (GB)
F2	1000	1000	300	10	3
F4	1000	1000	300	10	3
F8	1000	1000	300	10	3
F16	1000	1000	300	20	5
F32	1000	1000	300	40	10
F64/FT1/P1	5000	5000	1500	Unlimited	25
F128/P2	5000	5000	3000	Unlimited	50
F256/P3	5000	5000	6000	Unlimited	100
F512/P4	10000	10000	12000	Unlimited	200
F1024/P5	10000	10000	24000	Unlimited	400
F2048	10000	10000	24000	Unlimited	400

Limitations

- Relationships based on DateTime types
- Calculated Columns and Calculated Tables
 - Calculation Groups and Field Parameters do work
- User Defined Hierarchies will not work in Excel
- Complex delta table column types (i.e. Binary and GUID)
 - Some other
- T-SQL Based views will **always** fallback to DQ mode
- Composite models are not yet supported

Identifying Fallback

- You can tell when Fallback happens if ..
 - It's slower than usual 😊
 - Using the Performance Analyzer, you see a "DirectQuery" category
 - Performing a trace, you see DirectQueryBegin and DirectQueryEnd events
 - Depending on the behaviour, you get an error in the report(s)



Couldn't load the data for this visual

We cannot process the request because the table 'vw_Records' either does not exist or requires fallback to DirectQuery mode. Fallback to DirectQuery mode is disabled in this semantic model. Consider enabling fallback to DirectQuery mode and try again. See <https://go.microsoft.com/fwlink/?linkid=2248855> to learn more.

Close

Controlling Fallback Behaviour

- The FallbackBehaviour is set to 'Automatic' by default
- Alternative options are:
 - DirectLake only
 - DirectQuery only
- Be careful when making changes to this ..

Optimizing Delta for Direct Lake mode

Optimizing Delta for Direct Lake mode

- V-Order makes a big difference, as it's tailored for Verti-Scan
- Direct Lake will work over Shortcuts to external data
 - Expect a performance impact, because reasons ..
- Direct Lake thrives on fewer, larger .parquet files
 - Physical structure will always be crucial
 - OPTIMIZE (bin-compaction) and VACUUM in the Data Engineering process will be key
 - Especially with streaming/small batch architectures, keep this in mind
- Principle of lean models will still apply
 - Only include what's needed for the reports and datasets

Warming the cache

https://github.com/m-kovalsky/Fabric/blob/main/WarmDirectLakeCache_IsResident.py

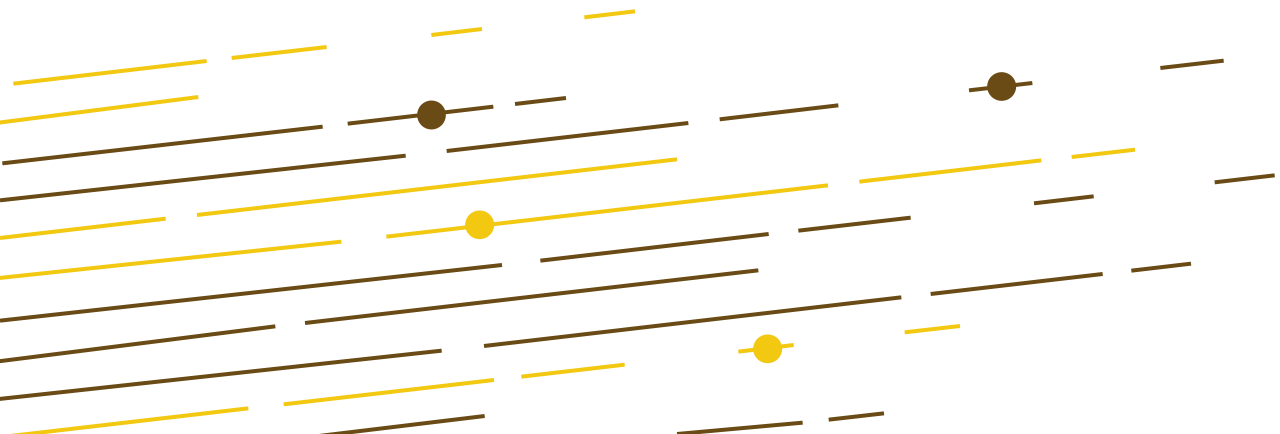
Wasn't there this thing called DirectLake over OneLake?

Common Answers to Common Questions

"Greatest Hits"

- Delta doesn't like spaces in object names 😊
- Delta Tables are a hard requirement for Direct Lake mode
 - Dataflows Gen2, Pipelines, Notebooks can create them for you in the lakehouse
- Web modelling is the recommended way to create DirectLake datasets.
 - We do allow to EDIT from Power BI Desktop
- XMLA Read/Write is supported, and allows web modelling
- Direct Lake doesn't have unique DAX limitations
 - DQ does ..

What does this mean for my data modelling?



STAR SCHEMA



imgflip.com

Thanks, @KoVer!

*Data should be transformed as far
upstream as possible, and as far
downstream as necessary.*

Matthew Roche, 2021

(The purple haired sword aficionado)

<https://ssbipolar.com/2021/05/31/roches-maxim>

Resources

- <https://learn.microsoft.com/en-us/power-bi/enterprise/directlake-overview>
- <https://learn.microsoft.com/en-us/power-bi/enterprise/directlake-analyze-qp>
- <https://learn.microsoft.com/en-us/fabric/data-engineering/lakehouse-pbi-reporting>
- <https://learn.microsoft.com/en-us/fabric/data-engineering/delta-optimization-and-v-order?tabs=sparksql>
- <https://fabric.guru/power-bi-direct-lake-mode-frequently-asked-questions>
- <https://www.fourmoo.com/2023/05/24/using-power-bi-directlake-in-microsoft-fabric/>
- <https://fabric.guru/controlling-direct-lake-fallback-behavior>
- <https://github.com/m-kovalsky/Fabric>



Slides

https://github.com/BenniDeJagere/Presentations/{Year}/{YYYYMMDD}_{Event}





Thank you

