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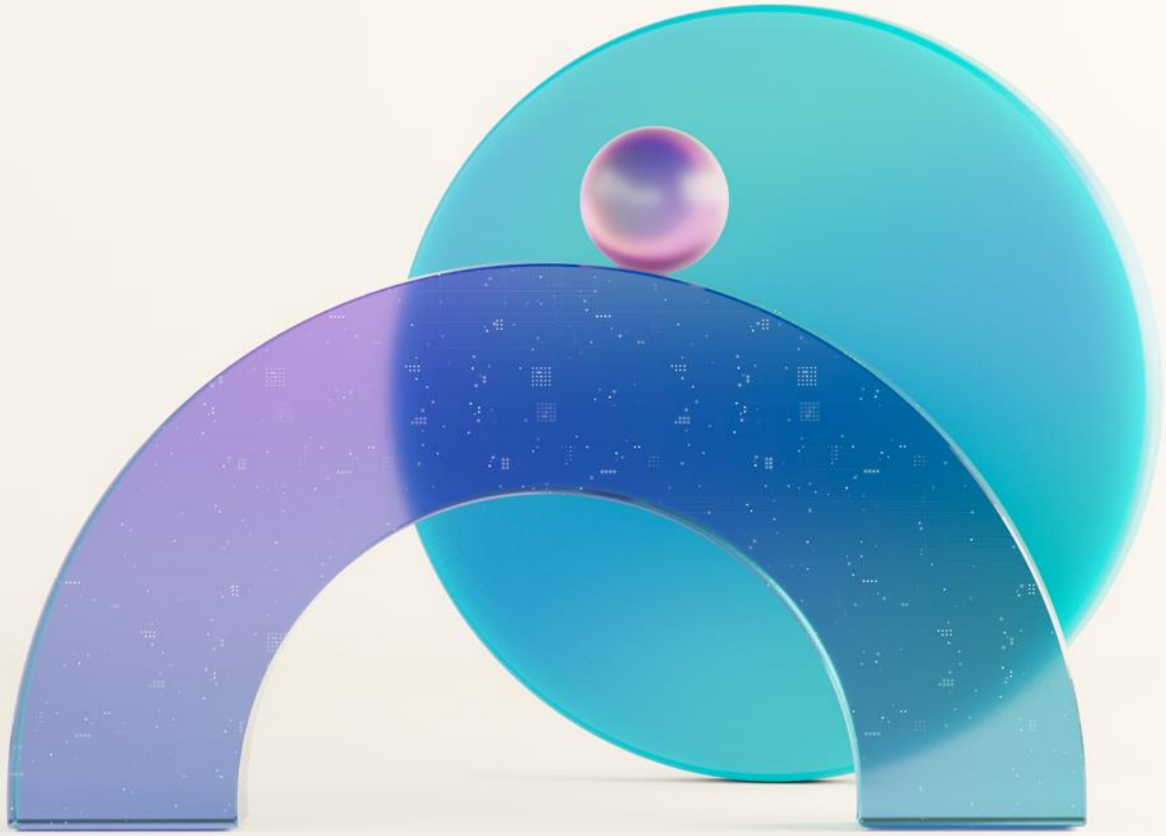

Factory in Microsoft Fabric Technical Deep Dive

March 26-28, 2024

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John Welch

Erwin de Kreuk

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  - Data Integration - ADF/Fabric Pipeline
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Erwin de Kreuk

- Principal Consultant
- Lead Data & Analytics InSpark

Let's connect

Microsoft® MVP Most Valuable Professional

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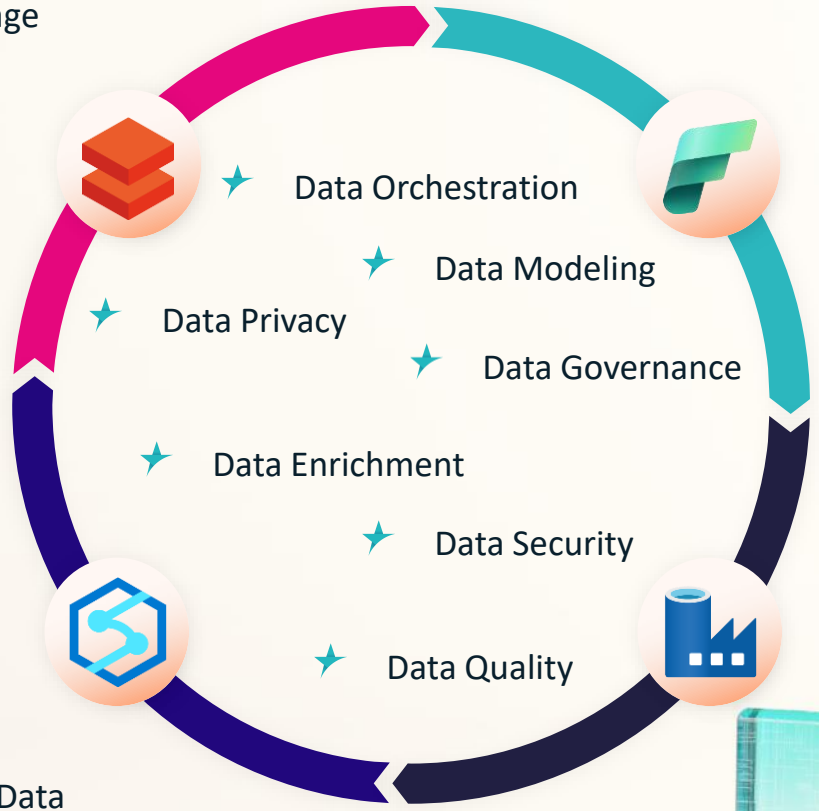
Objectives

- Overview of approach to Medallion Architecture
- Pipeline Architecture
- Dataflows
- Dataflow Architecture
- Recap

Data platform Challenges

'From data source to data model' to report

- Data Catalog
- Data Lineage
- Data Monitoring
- Incremental Loading
- Version Control
- Historical Data
- Medallion Architecture
- Large number of different data sources



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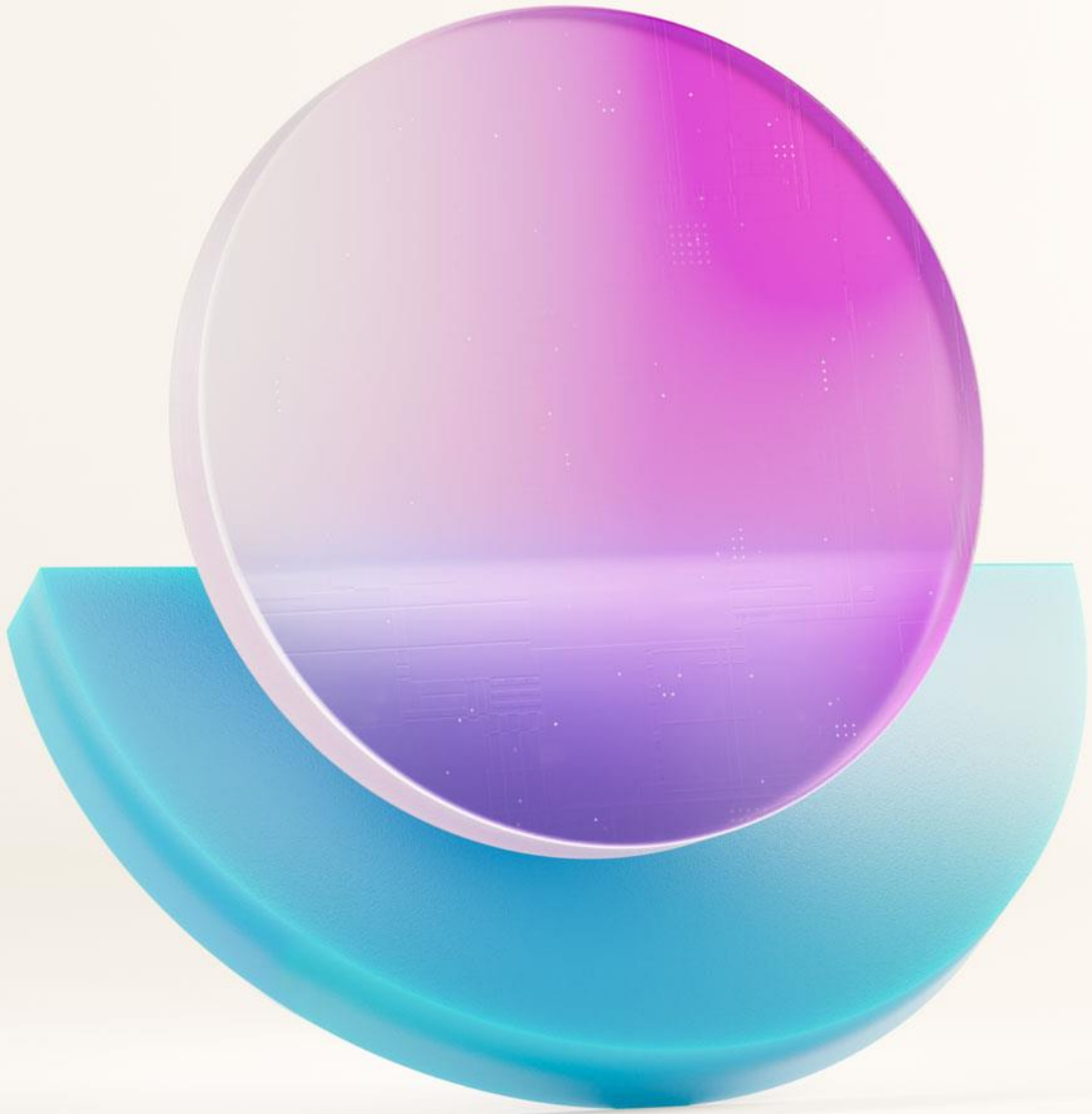


Lakehouse Medallion Architecture

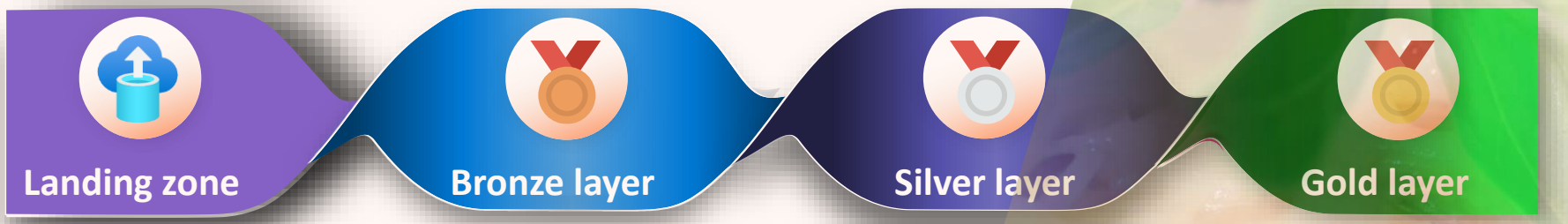
Who is using a Medallion architecture?

‘Uniform data architecture’
From data “Spaghetti to Lasagna”

Medallion Architecture

'Data processing in different stages'

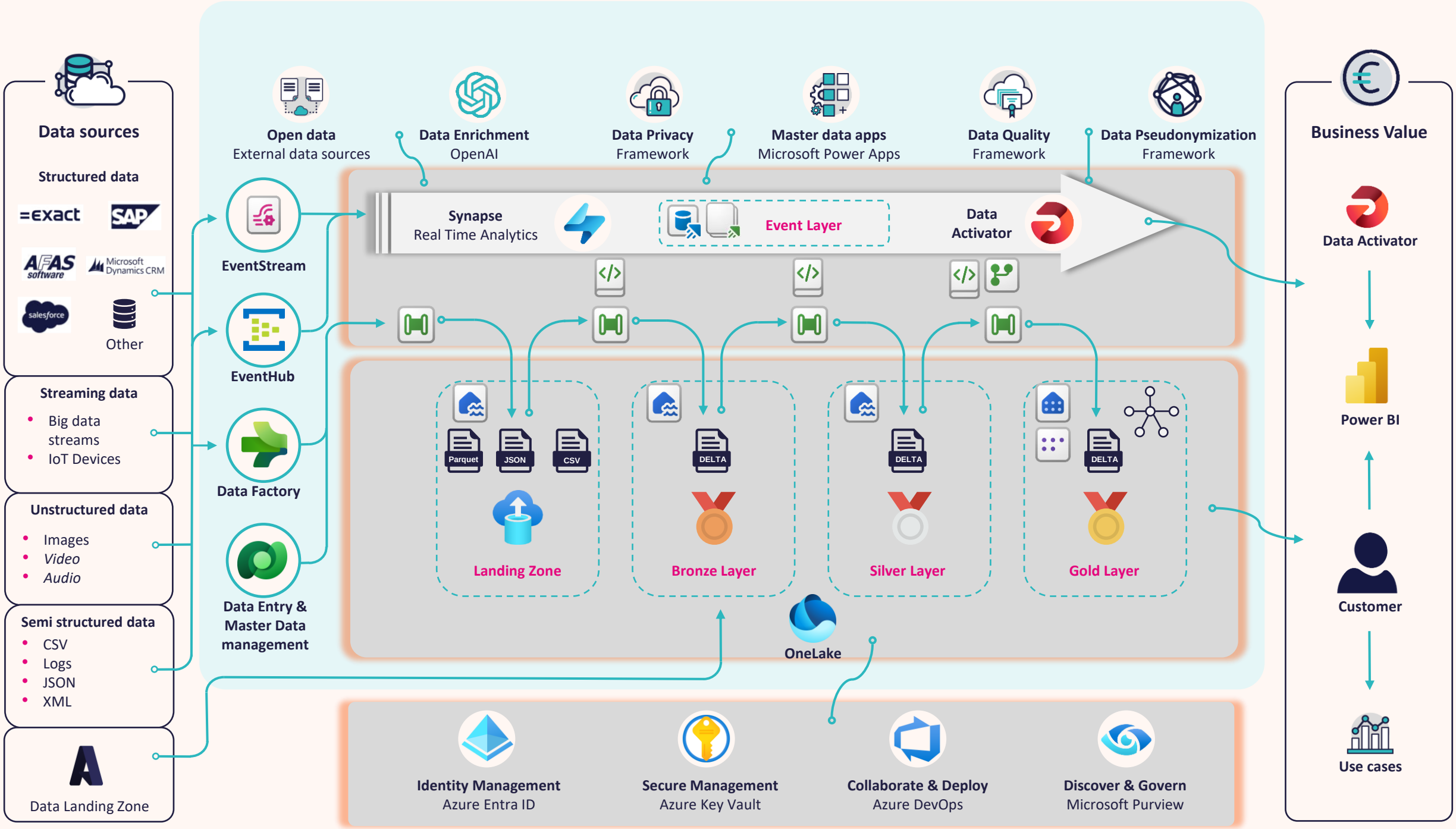
Stages



Medallion Architecture

'Data processing in different stages'

Stage:	Definition:	Filetype:	Files/Tables:	Fabric:
Gold layer	• Dimensions & Facts (Star Schema) • Historical Analysis • Business rules • Documentation • Aggregated data • Logical table names	Delta	Tables	SPROC, View
Silver layer	• Historical Data (Type 1 or 2) • Data quality rules • Data Cleansing • Validated data • No business model/data	Delta	Tables	
Bronze layer	• Deduplicate data • Add datatypes • Data can be inconsistent • Mostly a copy of the source • Schema	Delta	Tables	
Landing zone	• Structured data • Unstructured data • Incremental loads • Data as is • Stored in Datetime folder structure • No Schema	JSON, CSV, Parquet	File, Tables	


Data sources
Structured data
=exact
SAP
AFAS software
Microsoft Dynamics CRM
salesforce
Other
Streaming data
Big data streams
IoT Devices
Unstructured data
Images
Video
Audio
Semi structured data
CSV
Logs
JSON
XML
Data Landing Zone
Open data
External data sources
Data Enrichment
OpenAI
Data Privacy
Framework
Master data apps
Microsoft Power Apps
Data Quality
Framework
Data Pseudonymization
Framework
EventStream
EventHub
Data Factory
Data Entry & Master Data management
Synapse
Real Time Analytics
Event Layer
Data Activator
Parquet
JSON
CSV
DELTA
DELTA
DELTA
Landing Zone
Bronze Layer
Silver Layer
Gold Layer
OneLake
Identity Management
Azure Entra ID
Secure Management
Azure Key Vault
Collaborate & Deploy
Azure DevOps
Discover & Govern
Microsoft Purview
Business Value
Data Activator
Power BI
Customer
Use cases

PL_FABCON_COPY | Internal

fabr

Trial: 59 days left

15

Home | Activities | Run | View

Validate | Run | Schedule | View run history | Copy data | Dataflow | Notebook | Lookup | Invoke pipeline

Home
Create
Browse
OneLake data hub
Workspaces
FabCon
PL_FABCON_COPY
PL_FABCON_DEMO1
PL_FABCON_DEMO
PI_03_DEMO_LOAD_LA...
PI_03_DEMO_LOAD_AL...
...
Power BI

Start building your data pipeline

Add pipeline activity

Copy data

Choose a task to start

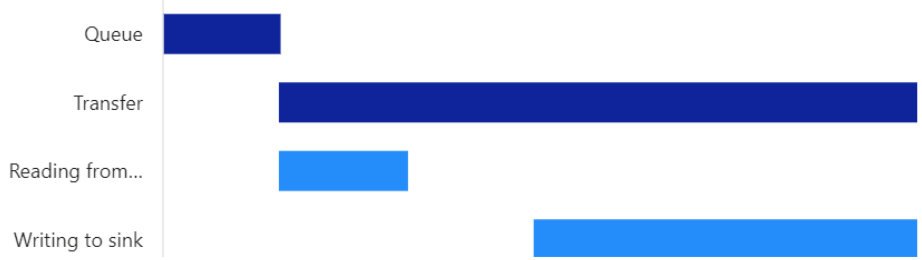
Copy Activity

- Queue 11 seconds
- Reading from Source 12 seconds
- Writing to Sink 35 seconds
- Transfer 60 seconds

Copy data details

Source		Destination	
Azure Data Lake Storage Gen2		Lakehouse	
Data read:	3,65 GB	Data written:	3,65 GB
Files read:	21	Files written:	21

Status	Succeeded
Start time	2/29/2024, 2:42:15 PM
Activity run ID	cec360c0-ed69-49c1-a3ea-c2033ecba3e6
Throughput	60,839 MB/s
Total duration	00:01:13
Duration breakdown	
Start time	2/29/2024, 2:42:17 PM
Optimized throughput	Standard
Used parallel copies	6



Close

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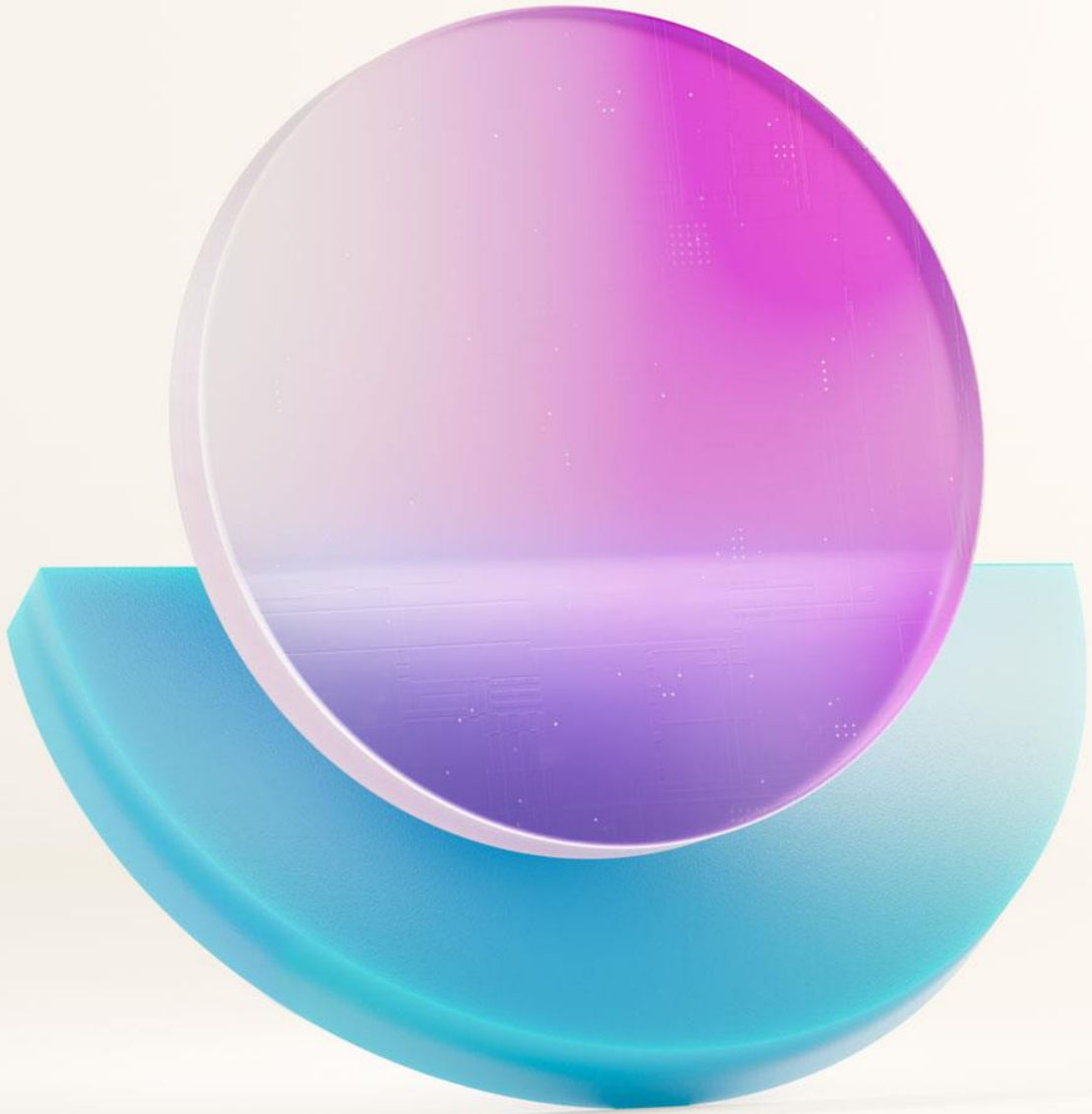
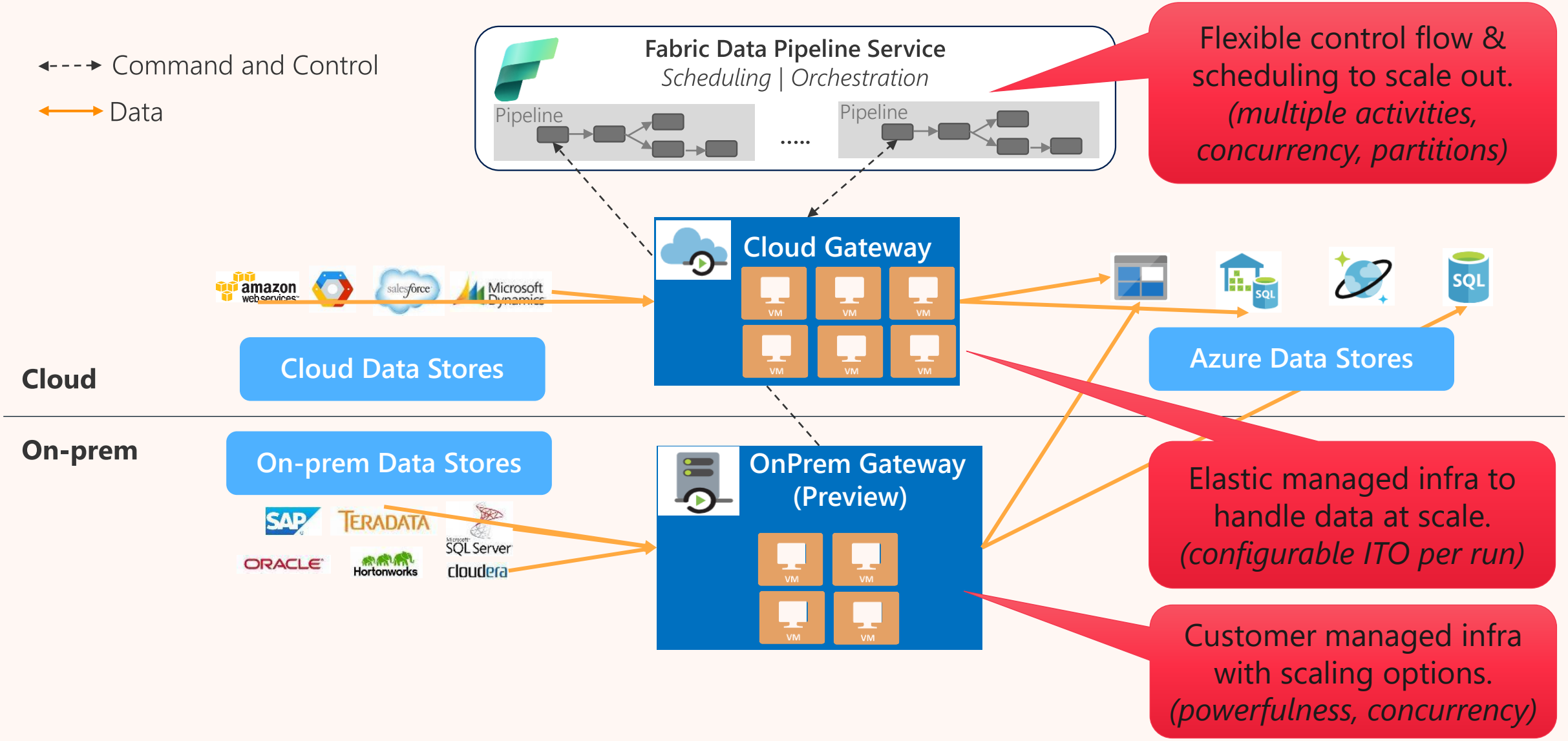


Pipeline Architecture

Understand How Pipeline Scales



Copy Performance Metrics

Parquet -> LH (binary)

Copy data details

loading 1t parquet to lh table binary

Source		Destination	
Azure Data Lake Storage Gen2		Lakehouse	
Data read:	1.049 TB	Data written:	1.049 TB
Files read:	5,120	Files written:	5,120

Status	Succeeded
Start time	2/26/2024, 9:05:34 PM
Activity run ID	b7fba58c-0504-462d-9eb9-fde707ad95a0
Throughput	5.141 GB/s
Total duration	00:03:31
Duration breakdown	
Start time	2/26/2024, 9:05:35 PM

CSV -> LH

Copy data details

Loading 1T csv to LH table

Source		Destination	
Azure Data Lake Storage Gen2		Lakehouse	
Data read:	1.049 TB	Data written:	353.654 GB
Files read:	5,120	Files written:	768
Rows read:	7,583,957,915	Rows written:	7,583,957,915

Status	Succeeded
Start time	2/26/2024, 3:21:25 PM
Activity run ID	b4c34be5-f653-461b-b4f7-3237167b42e9
Throughput	1.284 GB/s
Total duration	00:13:44
Duration breakdown	
Start time	2/26/2024, 3:21:27 PM

SQL -> LH

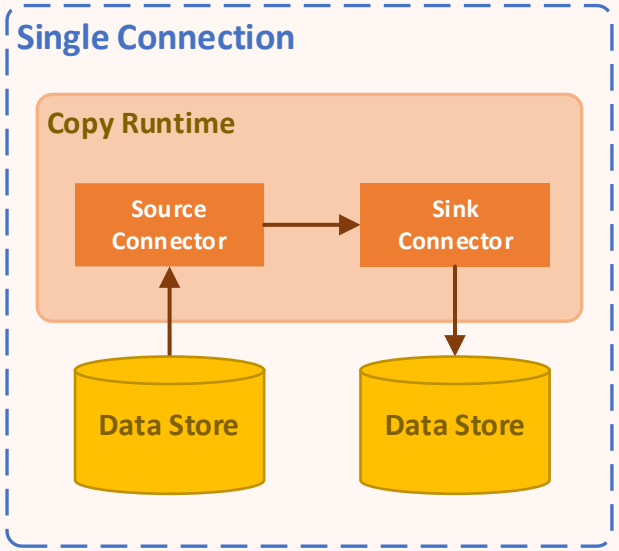
Copy data details

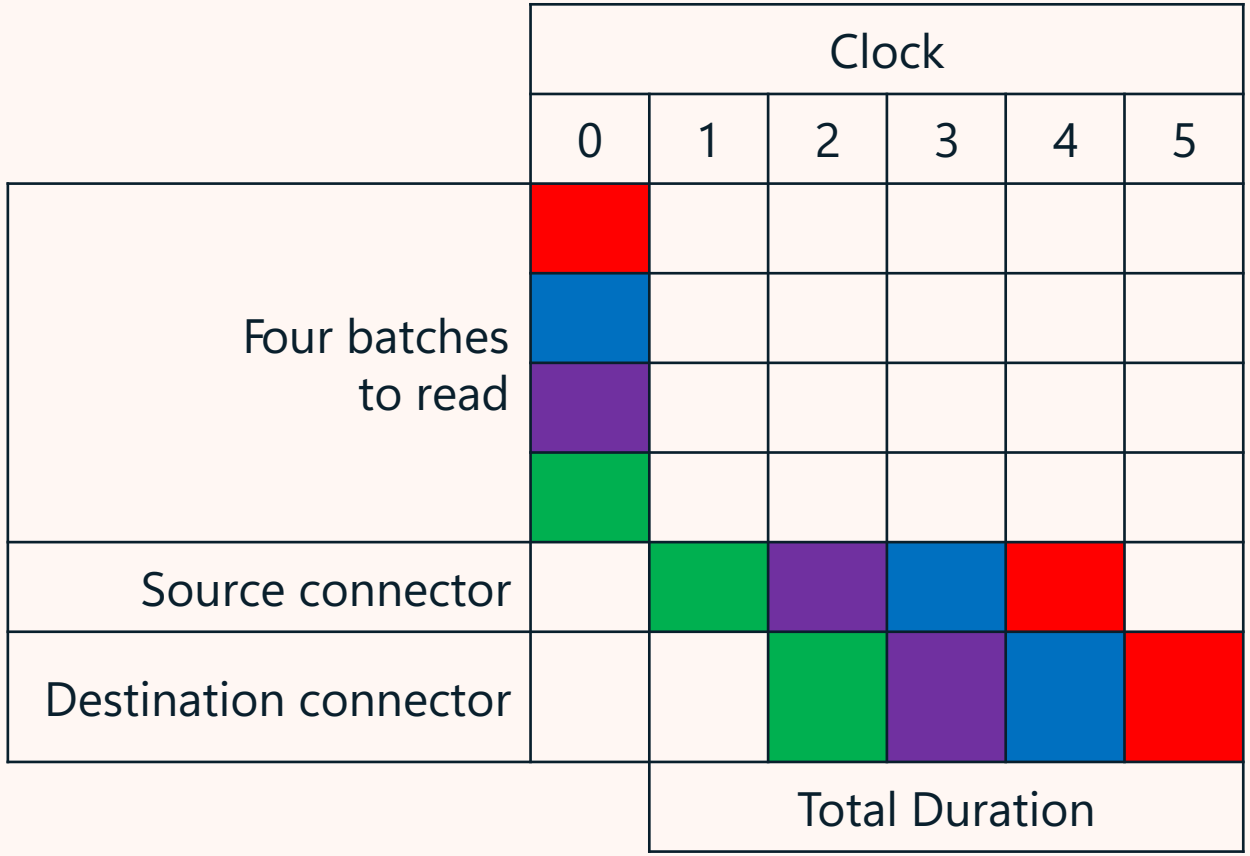
sql perf

Source		Destination	
Azure SQL Database		Lakehouse	
Data read:	127.292 GB	Data written:	24.172 GB
Rows read:	512,000,000	Files written:	256
		Rows written:	512,000,000

Status	Succeeded
Start time	3/6/2024, 10:29:11 PM
Activity run ID	45f452c0-4172-40ea-9a09-f4a87d8cb0e6
Throughput	1.354 GB/s
Total duration	00:01:41
Duration breakdown	
Start time	3/6/2024, 10:29:13 PM

How Copy Scales – Connection Level

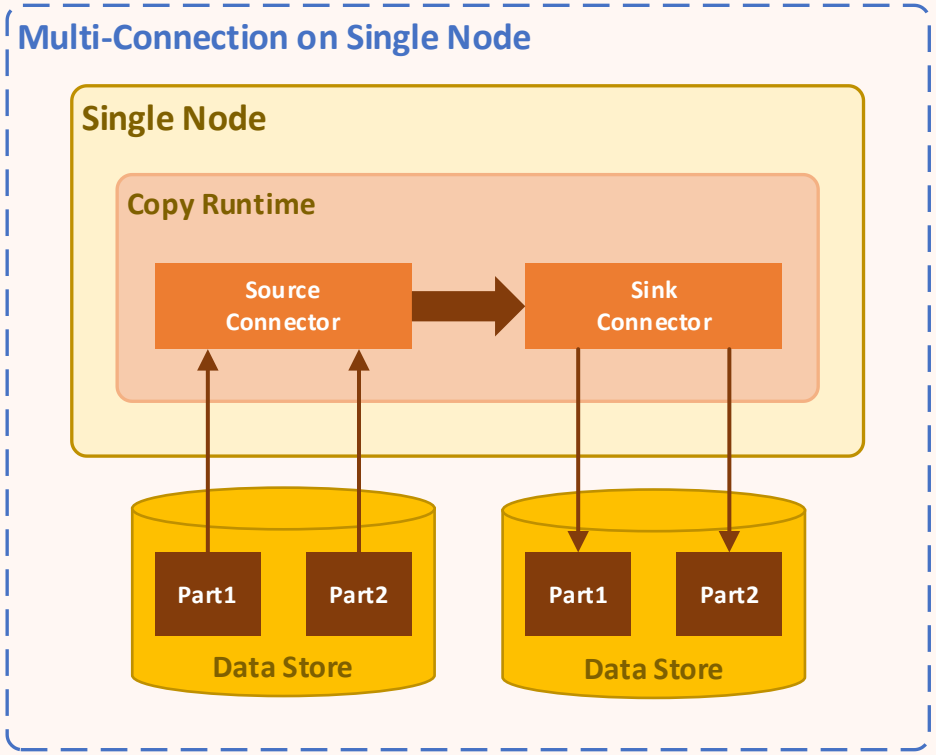




Pipeline processing

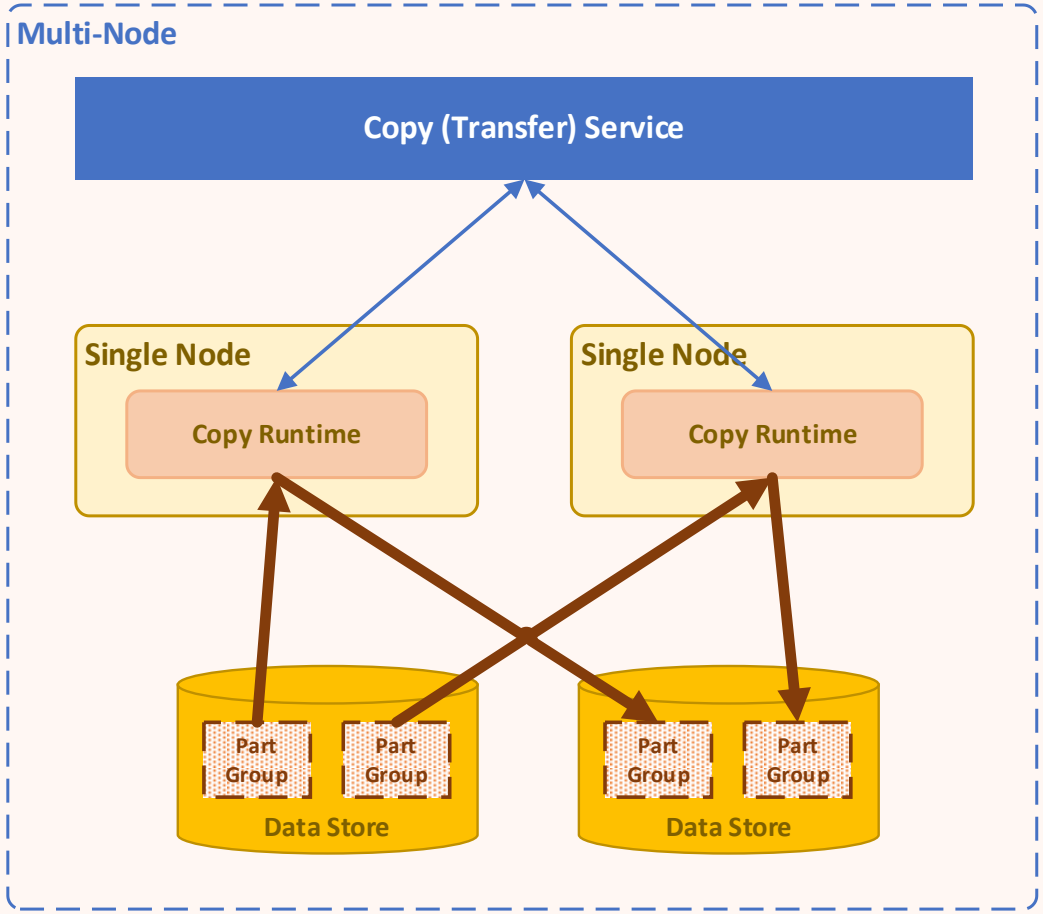
- **Less memory**: No need to load everything in memory and then write
- **Less total duration**: Read and Write are in parallel

How Copy Scales – Node Level



- Producer & Consumer design
  - Data is partitioned for multiple concurrent connections (even for single large file)
  - Full node utilization: Data can be partitioned differently between source and destination to avoid any starving / idle connection
- Partitions come from
  - Physical partitions setup on DB side
  - Dynamic partitions from different queries
  - Multiple files
  - Multiple parts from a single file

How Copy Scales – Multi-Node Level



- **Copy(Transfer) Service**: Manages Copy activities
  - Copy State Management / Monitoring
  - Cross Machine Parallelism
  - Billing
  - Manages Compute Clusters and tasks running on them
- Easily scale out to multiple stateless nodes when available partitions are more than what one node can afford.
- Theoretically no upper limit on the performance.

Copy Design Considerations

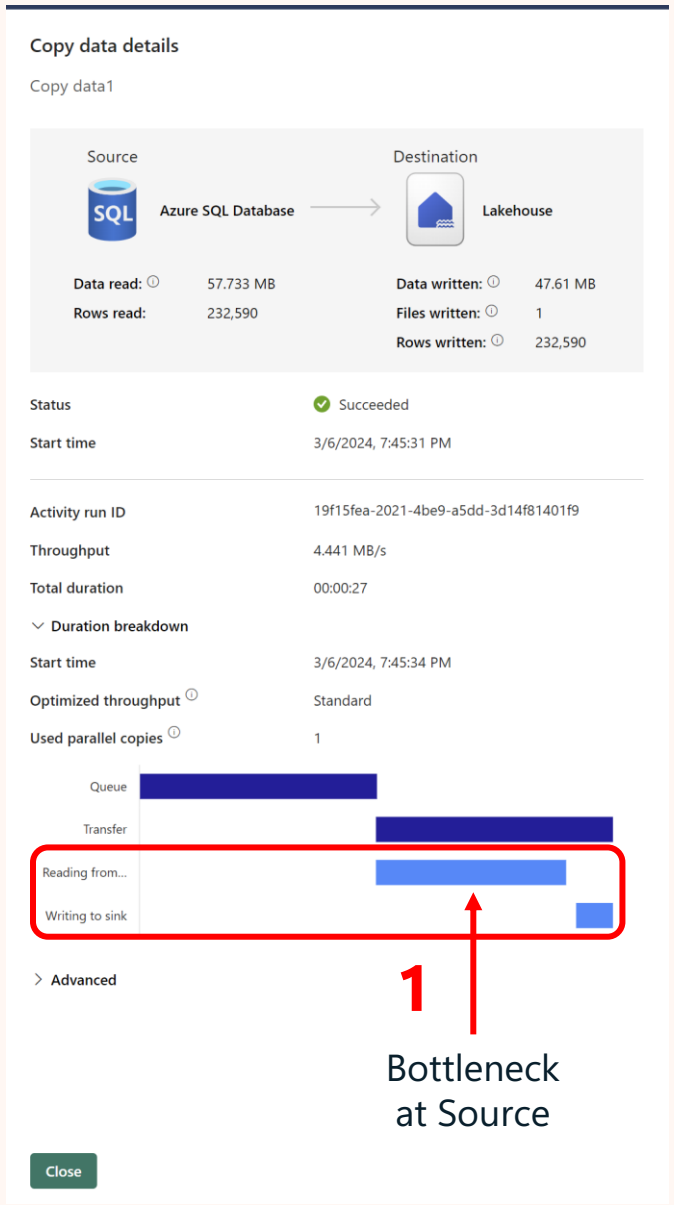
- Concepts
  - **Intelligent Throughput Optimization (ITO)**: A measure that represents the power (a combination of CPU, memory, and network resource allocation) used for a single Copy activity.
  - **Parallel Copy**: The maximum number of threads within the Copy activity that read from source and write to destination in parallel.
  - **Max Concurrent Connections**: The upper limit of concurrent connections established to the data store during the activity run. (Usually used to avoid throttling)
  - **Default perf settings**
    - Intelligent throughput optimization: **Auto** (Use maximum available VM resources)

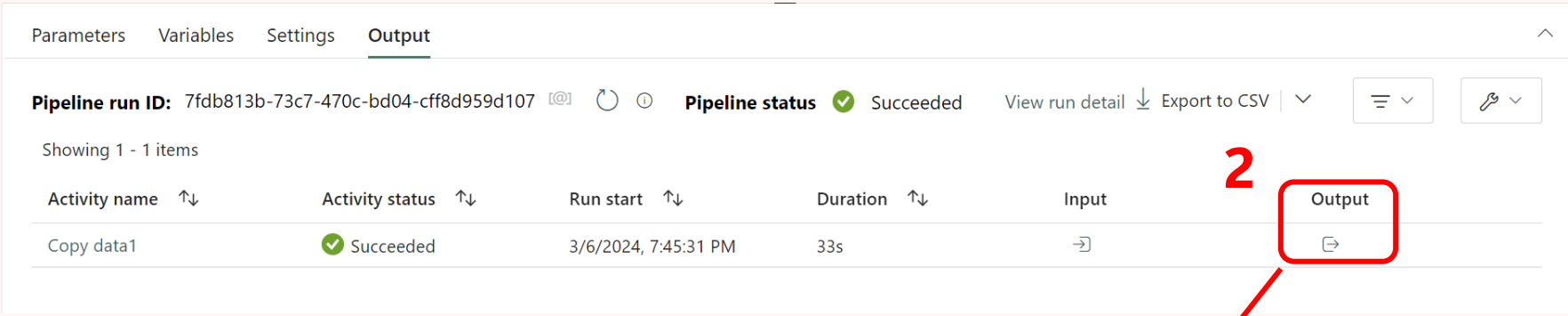
- Implementation details
  - Files based connectors
    - 1 file = 1 partition
  - Tabular connectors that support Partition read
    - SQL family, Oracle, Teradata, Azure PostgreSQL, Netezza, SAP HANA, SAP Table, SAP Open Hub

Troubleshoot Performance Issues

- Common bottlenecks
  - Network (cross region/OnPrem)
  - Source/Destination data stores
    - Busy neighbors on the same data store
    - Low service/compute tier
    - Throttling mechanism on data store
    - Complex/unoptimized query (huge timeToFirstByte)

Troubleshoot Performance Issues – Example





Indicating that most time was spent on preparing/running the query on DB side. Optimize the query or upgrade DB tier to eliminate this bottleneck.

3


```
"profile": {
    "queue": {
        "status": "Completed",
        "duration": 1
    },
    "transfer": {
        "status": "Completed",
        "duration": 13,
        "details": {
            "readingFromSource": {
                "type": "AzureSqlDatabase",
                "workingDuration": 10,
                "timeToFirstByte": 9
            },
            "writingToSink": {
                "type": "Lakehouse",
                "workingDuration": 1
            }
        }
    }
},
```

Leveraging the Architecture

- Carefully consider number of parallel activities
- Understand Source and Destination capacity
- Set ITO to Auto and let Copy Engine tune resources

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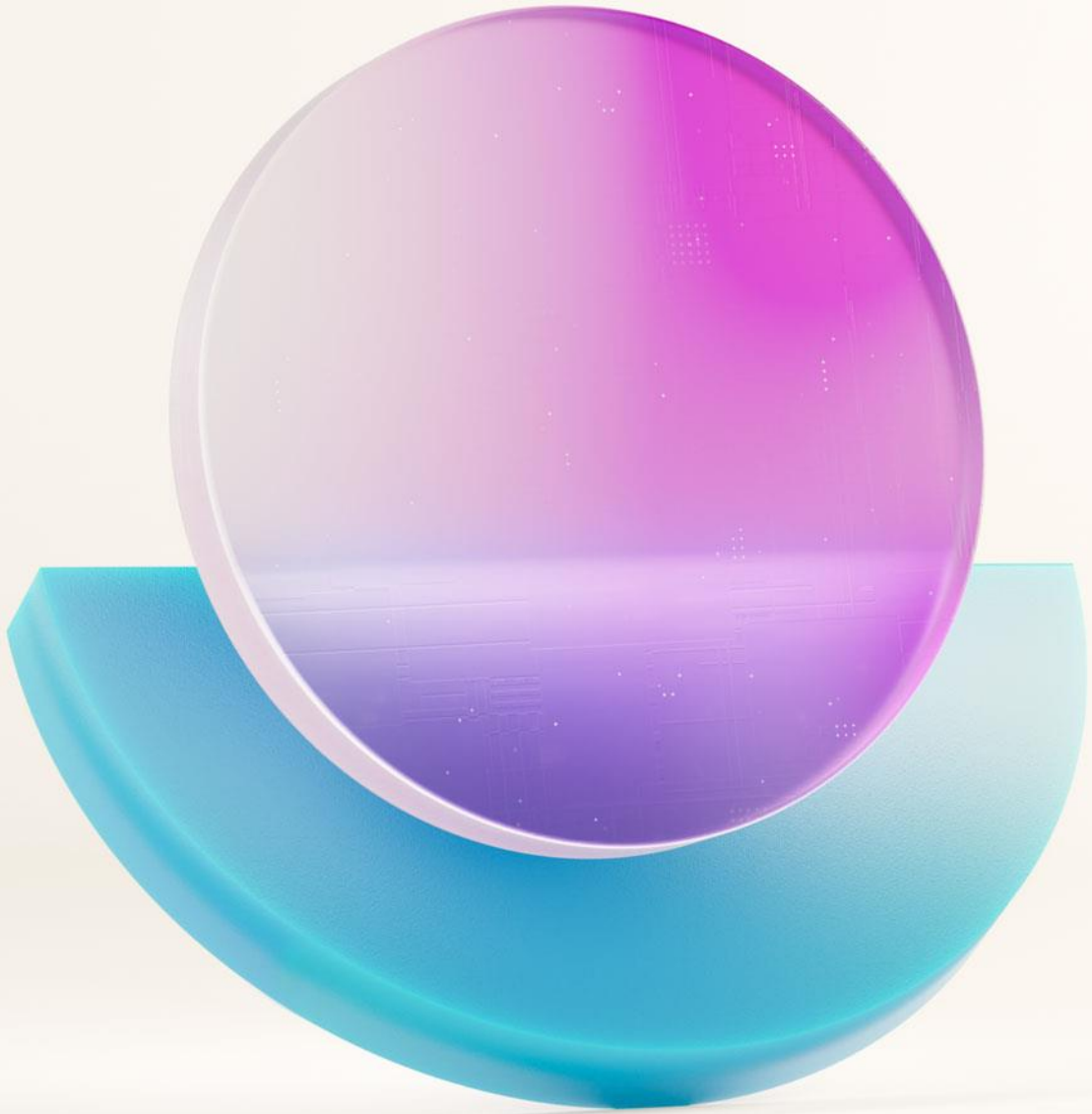


Dataflows

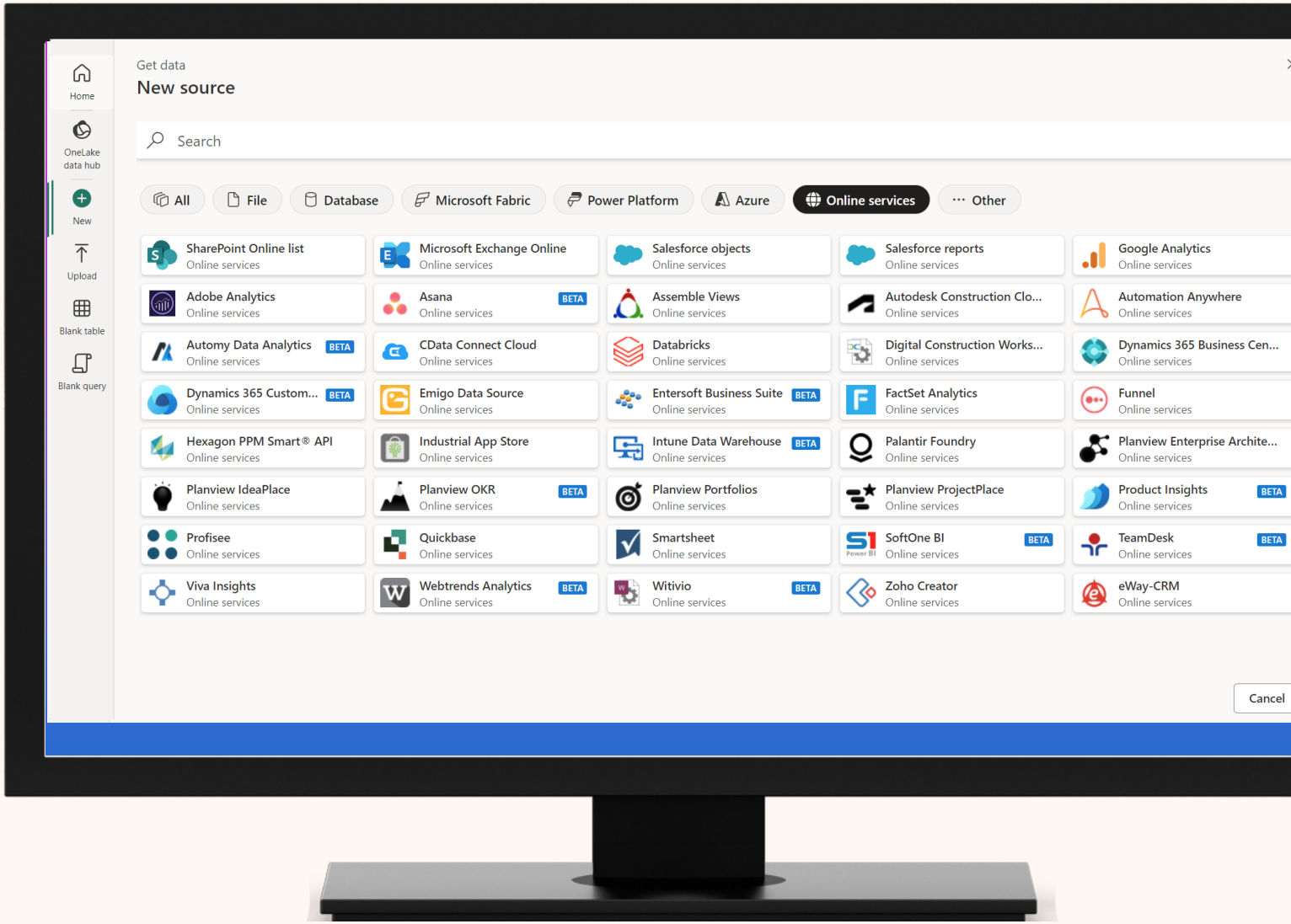
Dataflows Gen 2

- Dataflow Gen 2 in **Microsoft Fabric** is a powerful data preparation technology that allows you to create, transform, and load data into Fabric and Azure destinations. Here's what you can do with it:

- **Create Dataflows:**
  - Dataflows are self-service, cloud-based tools for data preparation.
- **Get Data:**
  - Dataflows enable you to retrieve data from 100s of on-premise and cloud data sources.
- **Apply Transformations:**
  - Once you've connected to your data source, it's time to shape it according to your needs.
  - Use the Power Query editor to apply transformations. For instance:
    - Calculate the total number of orders per customer using the Group By feature, combine, remove columns, etc.
- **Configure Destinations:**
  - Specify a destination to store the results of the query and transformations.
- **Publish Dataflows:**
  - After applying transformations, you can publish your dataflow so that it can start processing data.

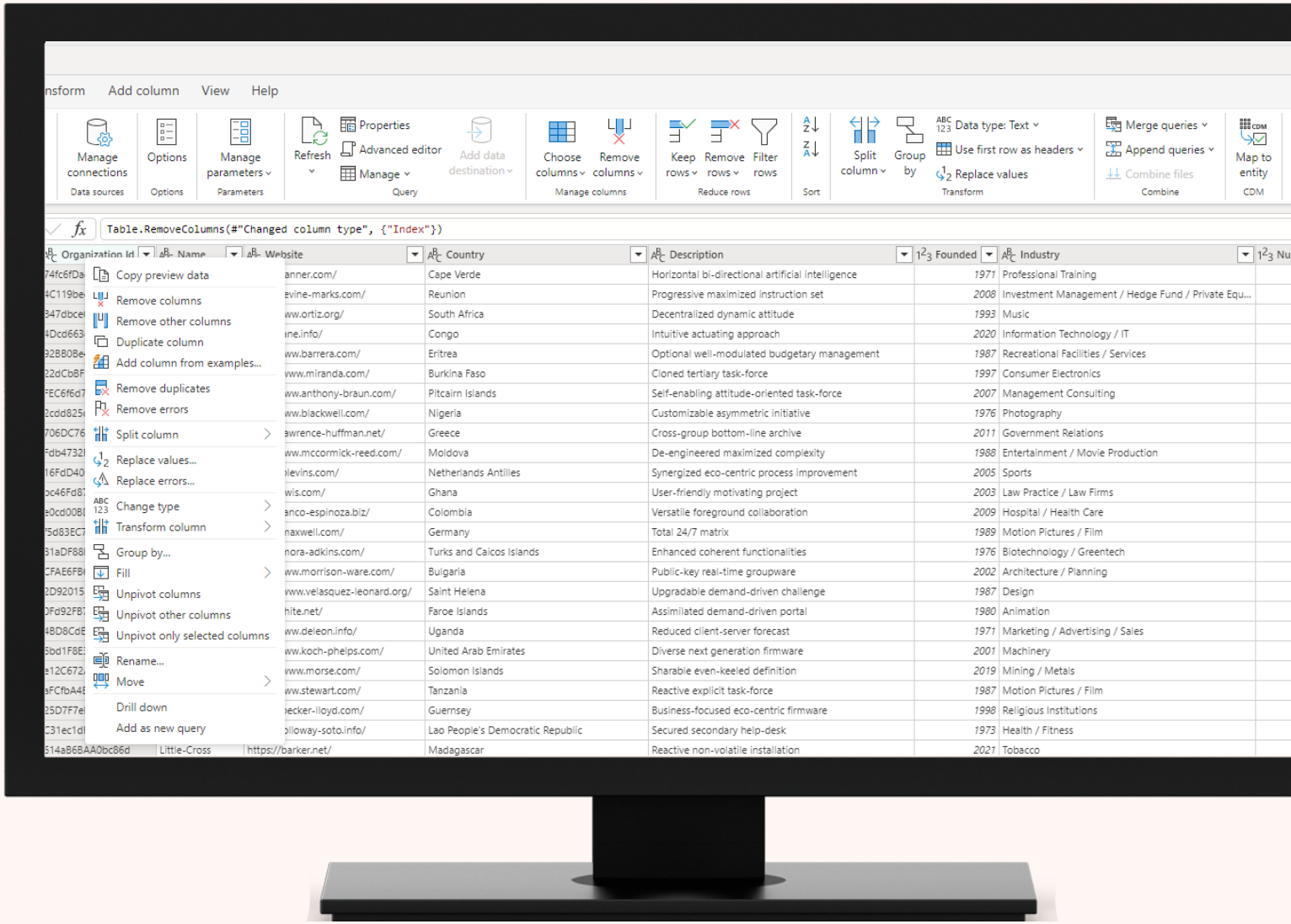
Get Data

- Fabric
- Database
- Azure
- ~175 connectors



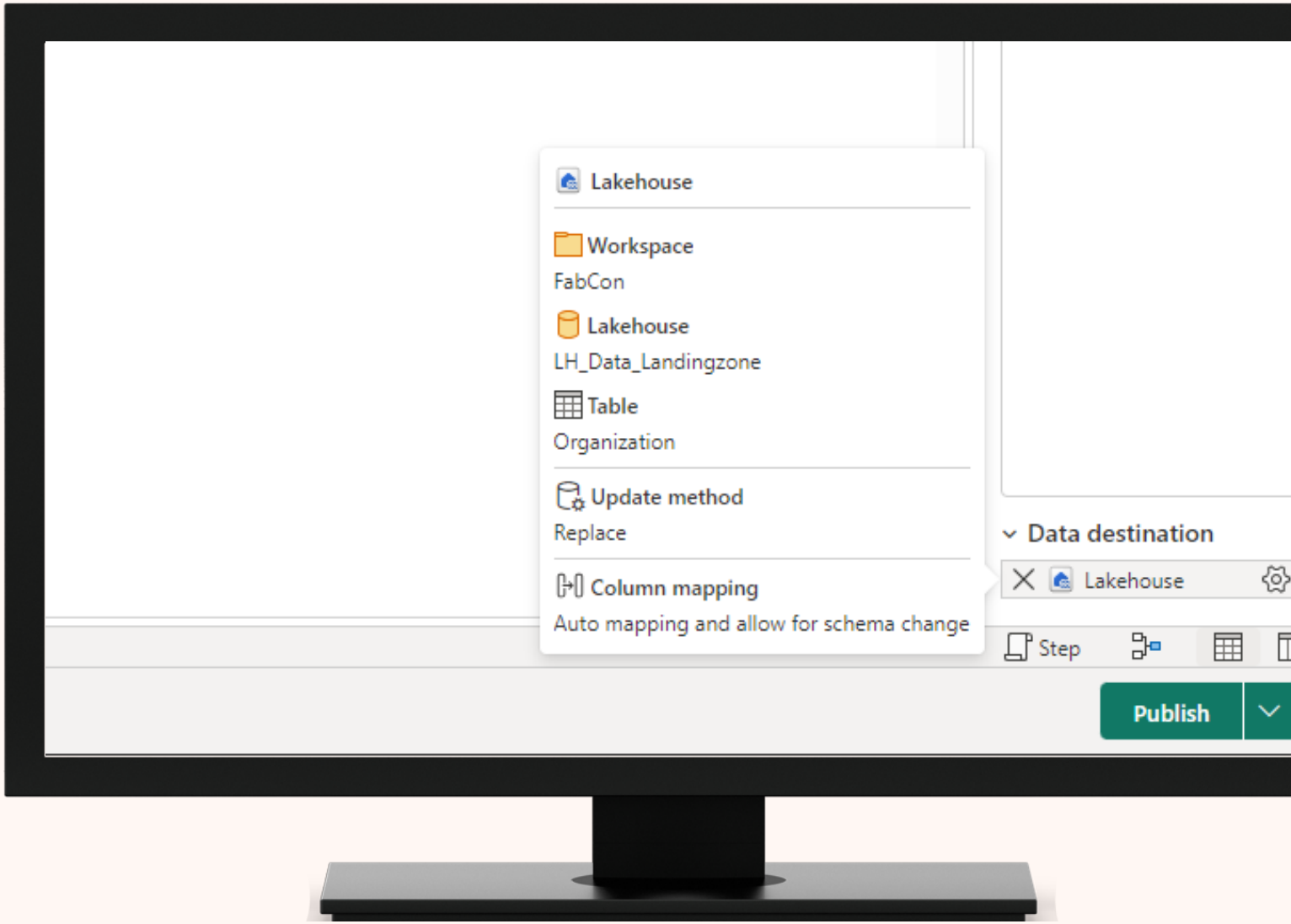
Apply Transformations

- Change data types
- Remove Columns
- Aggregations



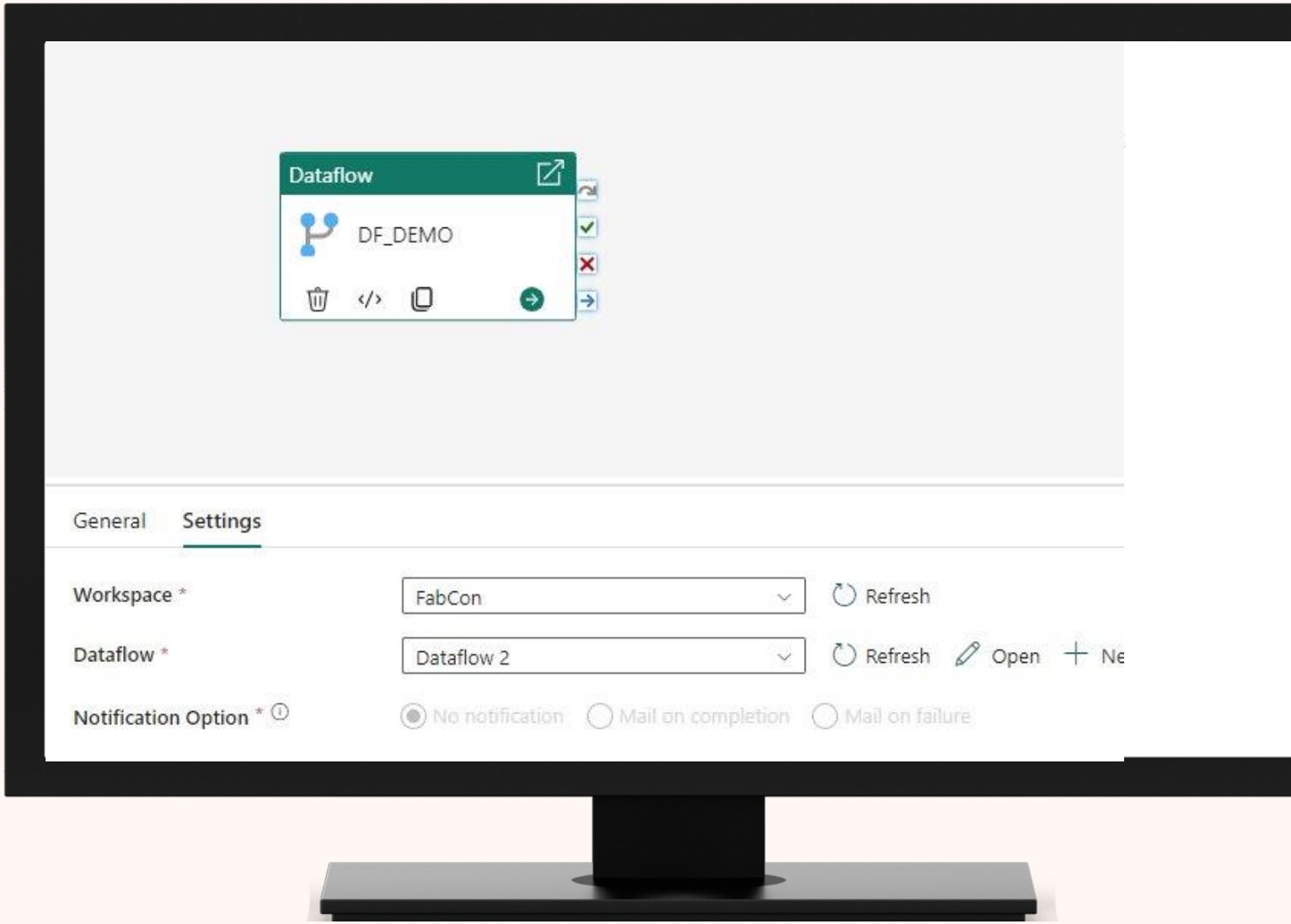
Publish Dataflows

- Select Destination
  - Lakehouse
  - Warehouse
  - Azure Data Explorer
  - Azure SQL Database
    - More to come



Refreshing Dataflows

- Schedule dataflow refreshes for automatic operation
- Execute from a pipeline



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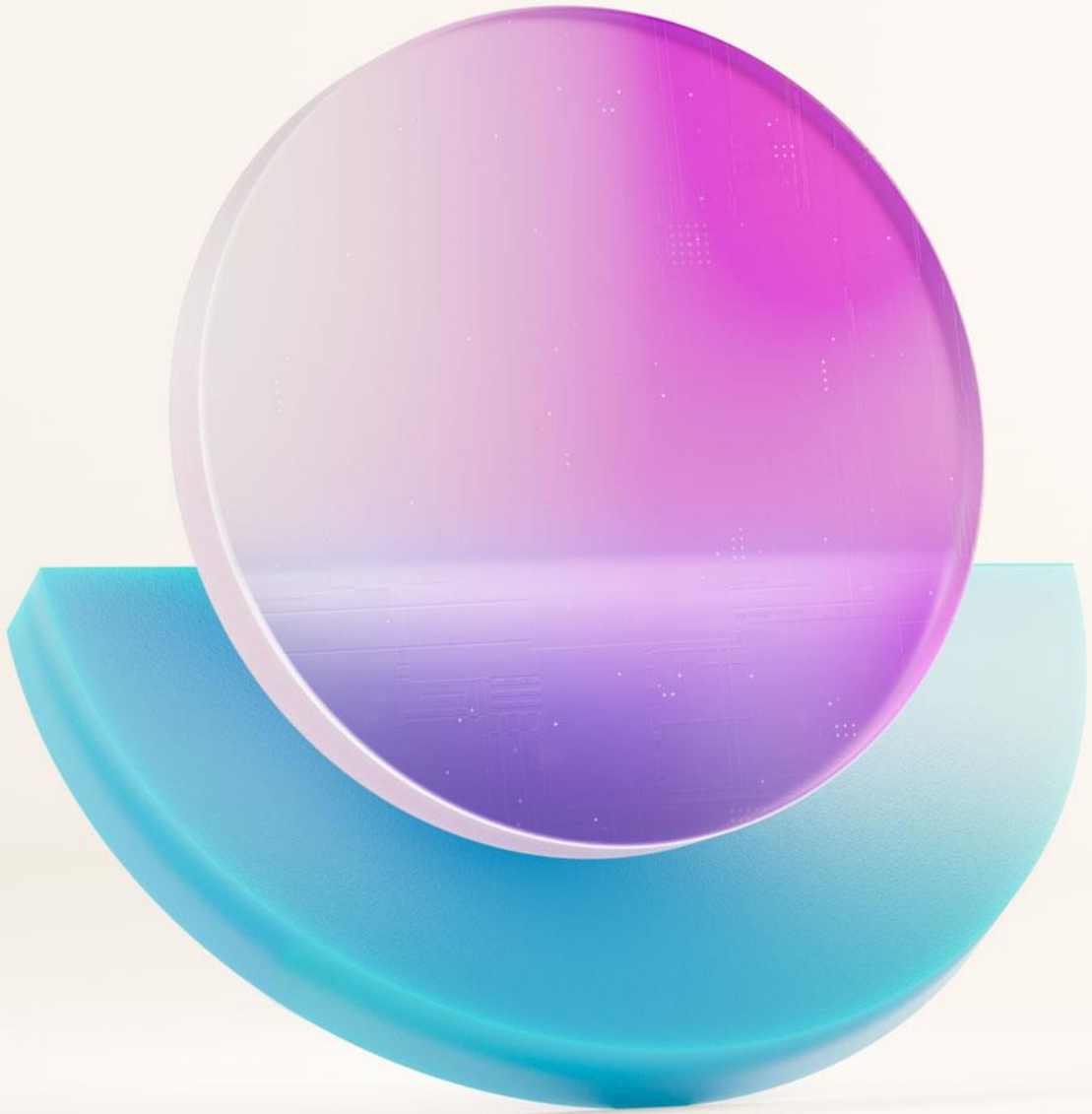
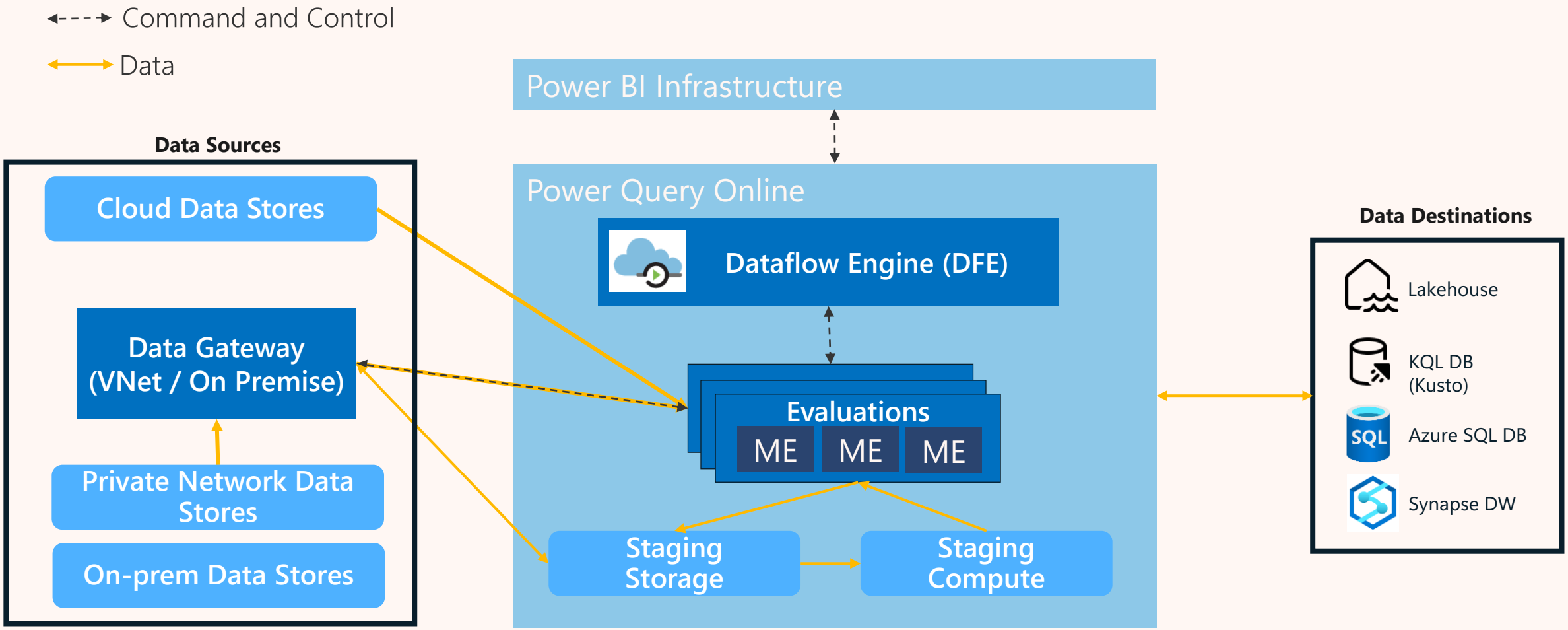
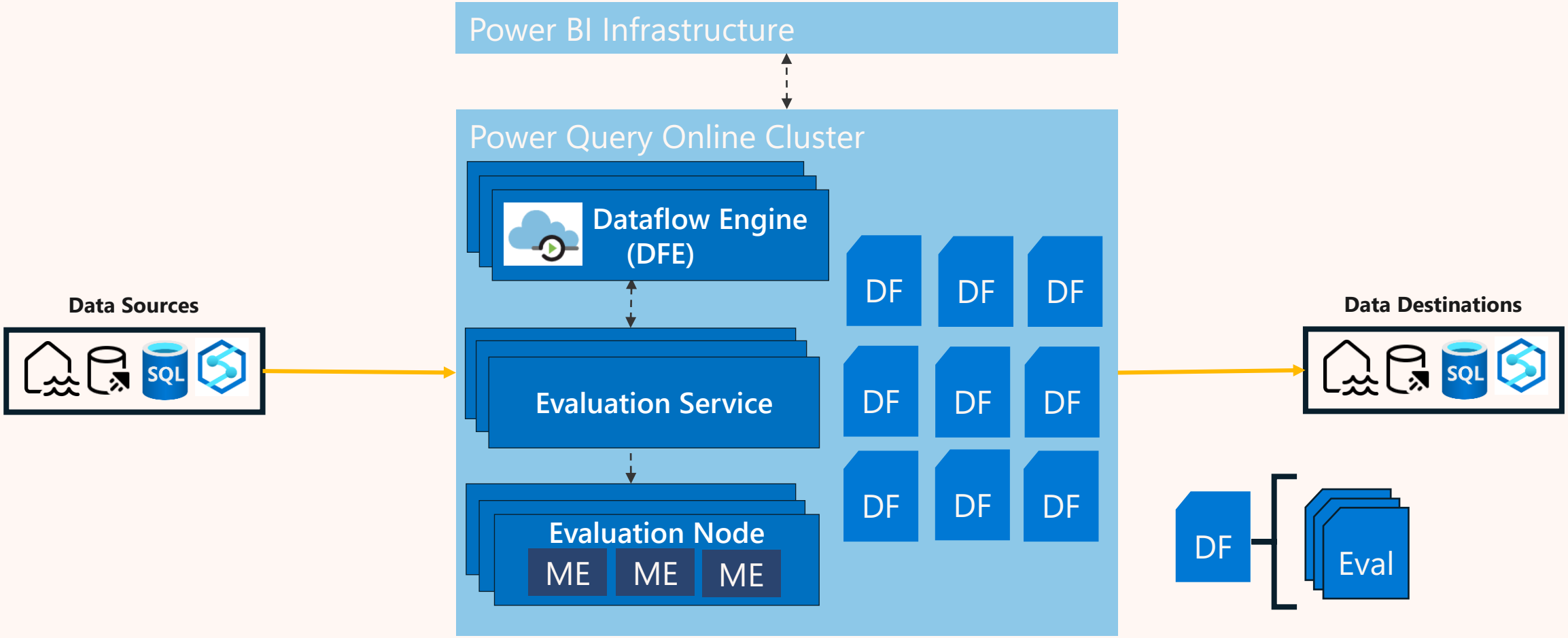


Dataflow Architecture

Fabric Dataflows (aka Gen2)

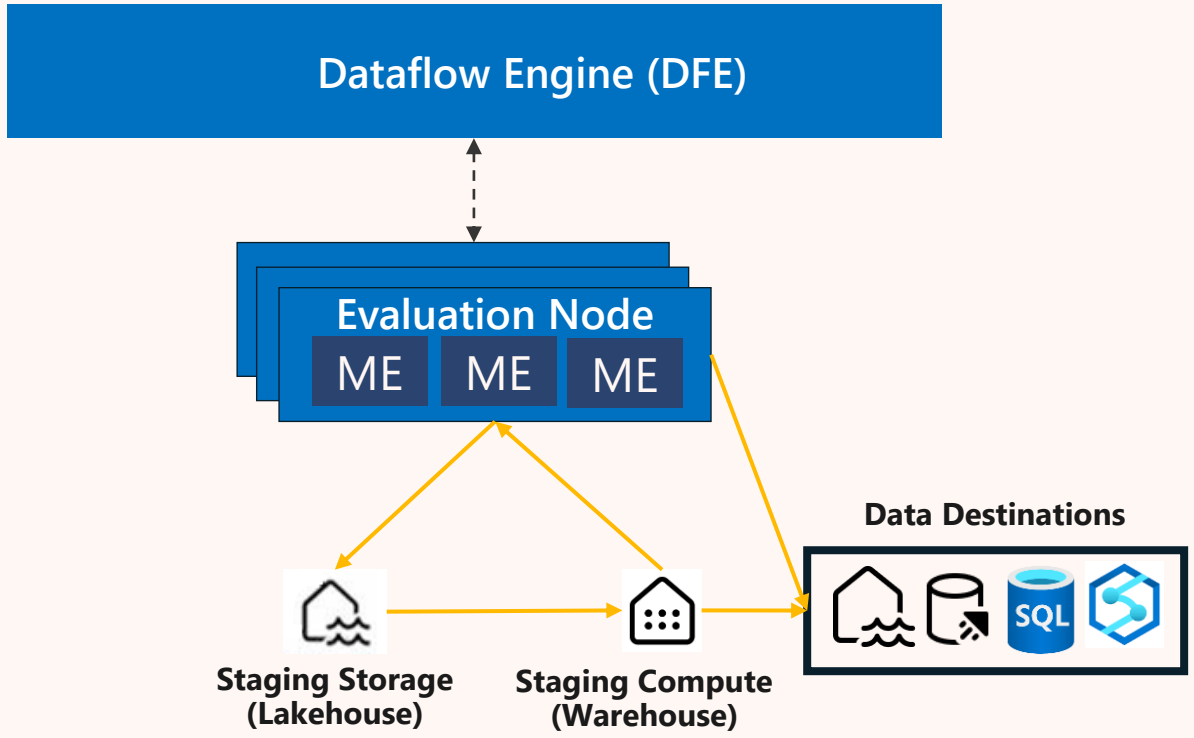


Fabric Dataflows Scale Out



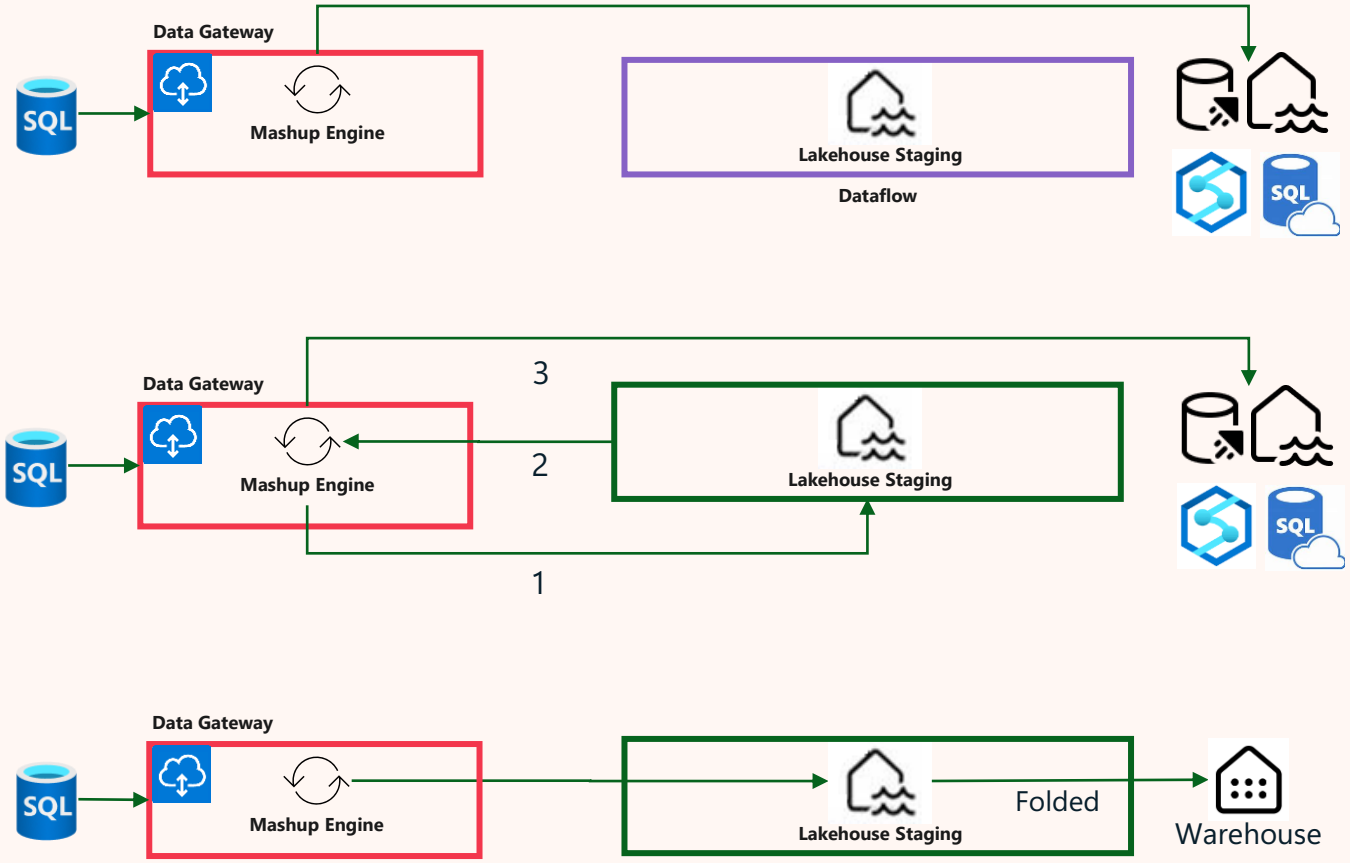
Staging

- Capabilities
  - Landing zone for incoming data
  - Provides a staging point tied to the dataflow / entity refresh
  - Provides WH Compute to speed up operations
- When to use it
  - Combining data from multiple sources
  - Stage data once for subsequent use
  - Writing to WH destination (required)
  - Merging, sorting, grouping, aggregating (uses WH compute)
- When to skip it
  - No value added for entities that write to non-WH destinations
  - See Gateway (next)

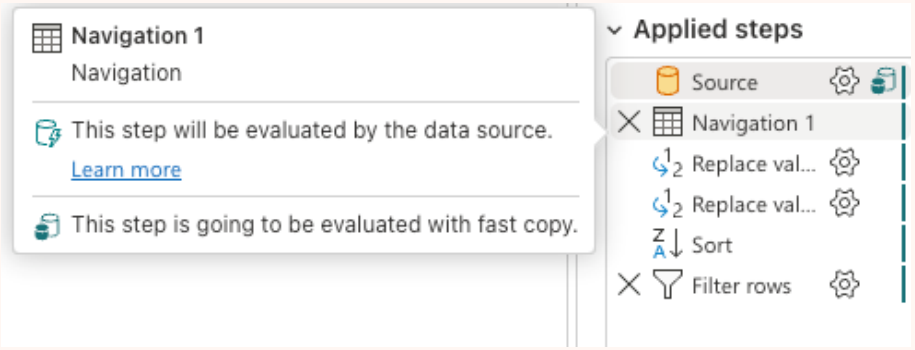


Data Gateway (VNET / On Premise)

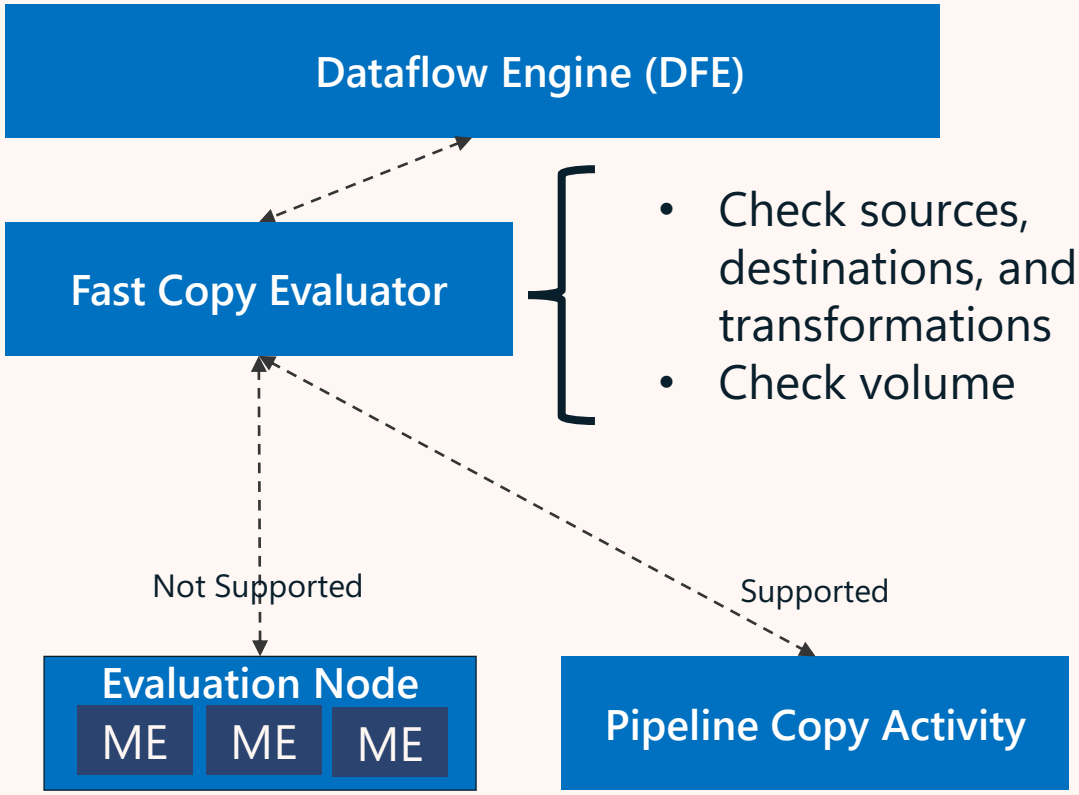
- Capabilities
  - Enables access to data sources without exposing them to the internet
  - Data is processed locally
- When to use it
  - Data source is inside your private network
  - Move compute closer to source
  - Control where evaluations happen
- When to skip it
  - Entities that stage data and write to destination (excluding WH)
    - Split Ingest and Destination into separate dataflows (consider where to Transform)
    - Don't stage



Fast Copy



- Capabilities
  - Leverages Pipeline Copy Activity for large performance boost in ingest
  - Automatically used based on pattern matching and volume
  - Transparent (no pipeline to manage)
- When to use it
  - Whenever possible
    - Defer transformations to post ingest if they affect Fast Copy use
  - Enable in Options..Scale..Allow use of fast copy connectors
- When to skip it
  - Don't – if it's an option, use it
  - Mark as "Require fast copy" to enforce



Leveraging the Architecture

- Carefully consider ETL vs ELT when laying out dataflows
- Know why you are using staging
  - Accelerates some operations, but adds no value to others
- Avoid “double-hops” with Data Gateways
- Take advantage of Fast Copy wherever possible
  - As patterns are added, dataflows can automatically benefit
  - Enable “use fast copy connectors”
  - Ensure that queries fully fold to maximize fast copy usage
- Build for parallel processing
  - Evaluations, dataflows
  - Incremental refresh when available

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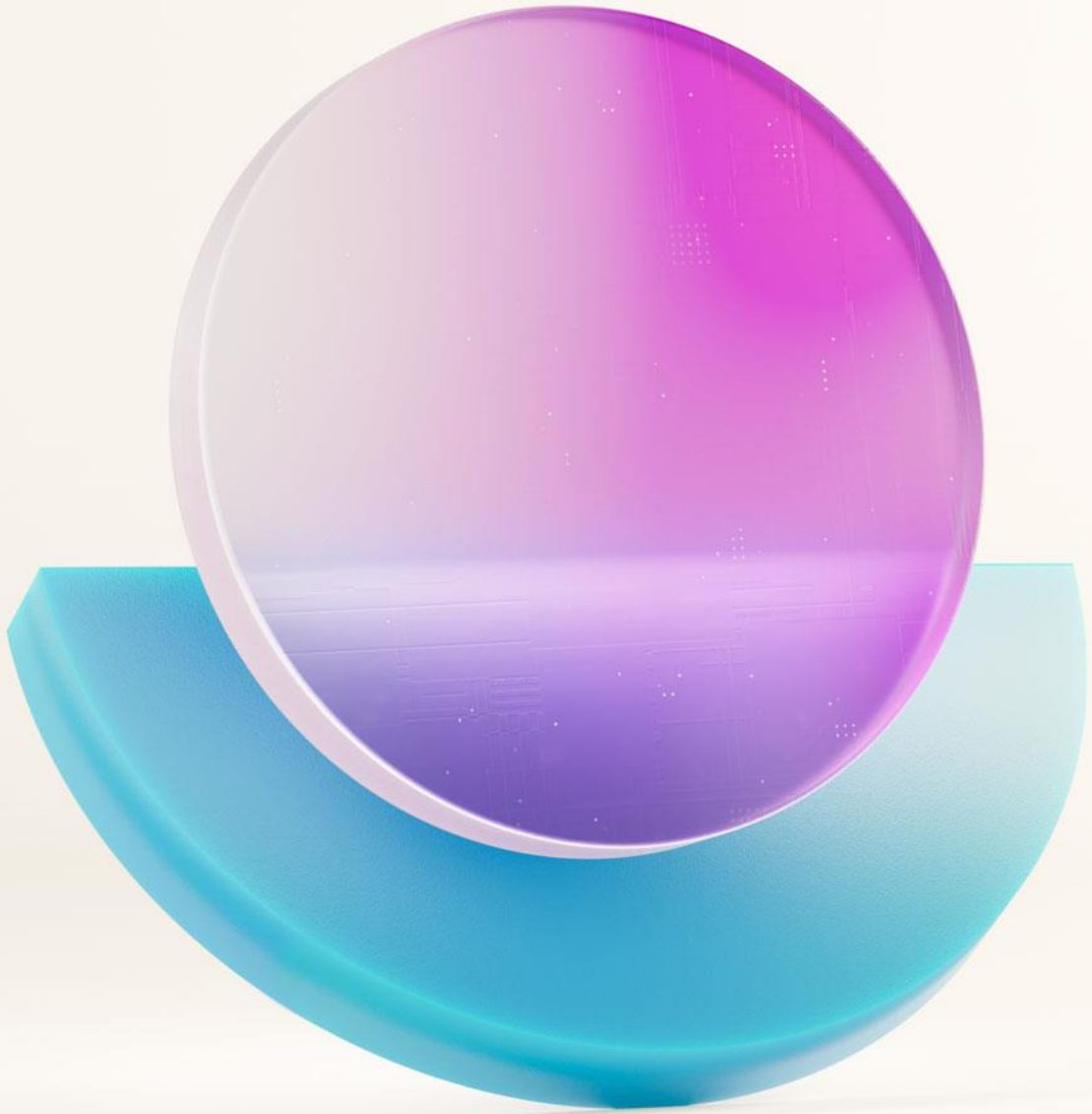

Q&A

Data Factory - Data Integration Sessions

TUESDAY

Getting Started with Data Factory
Speakers: Shireen Bahadur, Cathrine Wilhelmsen (MVP)
TUESDAY @ 11:30am

Connecting to the World's data using Data Factory
Speakers: Matt Masson, Miguel Escobar, Jianlei Shen
TUESDAY @ 11:30am

Behind the Design: Crafting Data Factory Experiences in Fabric
Speakers: Cristin Ford, Arian Martinez, Vichita Jianjitlert
TUESDAY @ 2pm

From Data to Decisions: Leveraging Microsoft 365 with Data Factory
Speakers: Wilson Lee, Karan Shah, Rishi Girish
TUESDAY @ 3:15pm

WEDNESDAY

Modern Data Integration with Microsoft Fabric Data Factory
Speakers: Wee Hyong, Shabnam Watson (MVP), Penny Zhou
WEDNESDAY @ 8am

Customer Stories: Data Integration
Speakers: Andre Fomin, Tom Peplow
WEDNESDAY @ 8am

Data Factory in Microsoft Fabric Technical Deep Dive
Speakers: Mohan Sankaran, John Welch, Erwin de Kreuk (MVP)
WEDNESDAY @ 9:15am

Performance Tuning Secrets for Data Factory
Speakers: Sid Jayadevan, Mark Kromer, Matt Masson
WEDNESDAY @ 11:15am

Implement Enterprise Data Integration Patterns with Data Factory
Speakers: Abhishek Narain, Miquella de Boer, Noelle Li
WEDNESDAY @ 1:45pm

THURSDAY

Upgrade Pathways and Best Practices for Data Factory
Speakers: Mark Kromer, Miguel Escobar, Mike Carlo (MVP)
THURSDAY @ 11am

Using Azure AI Services with Data Factory
Speakers: Abhishek Narain, Joroen Luitwieler
THURSDAY @ 1:30pm

Empowering Self-service BI on SAP Data with Microsoft Fabric
Speakers: Abhishek Narain, Joroen Luitwieler
THURSDAY @ 2:45pm

New Features for DI at #FabCon

GENERAL AVAILABILITY

VNET Data Gateway support with Private Links for Dataflows Gen 2 in Fabric

PREVIEW

Data Pipelines access on-premises data using "On Premises Data Gateway" (OPDG)

Fast Copy for Dataflows

40 to 80 activity limit in Data Pipelines

Semantic Model Refresh

CI/CD in Data Pipelines

Cancel Dataflow Refresh

SPN support for VNET Data Gateway

Modern Get Data – browse Azure Connections

Dataflow output destinations – Support for schema changes for Lakehouse & Azure SQL DB

SNEAK PEAK

Incremental Refresh for Dataflows

Interested in Connecting with the Product Group?

Please email us at
Fabcon-DI-Speakers@microsoft.com
for any questions!

aka.ms/FabricCommunity

Ask and answer questions in the Fabric Community forum

aka.ms/FabricUserGroups

Find a user group in your area or to match your interests

Community Lounge Meet Ups

Check Whova for official meetups with user group leaders, MVPs, Super Users and more!

Meet Speakers & the Product Group

Check Whova for the full schedule of speaker Q&A and PG meet & greets in the Community Lounge.

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Thank you