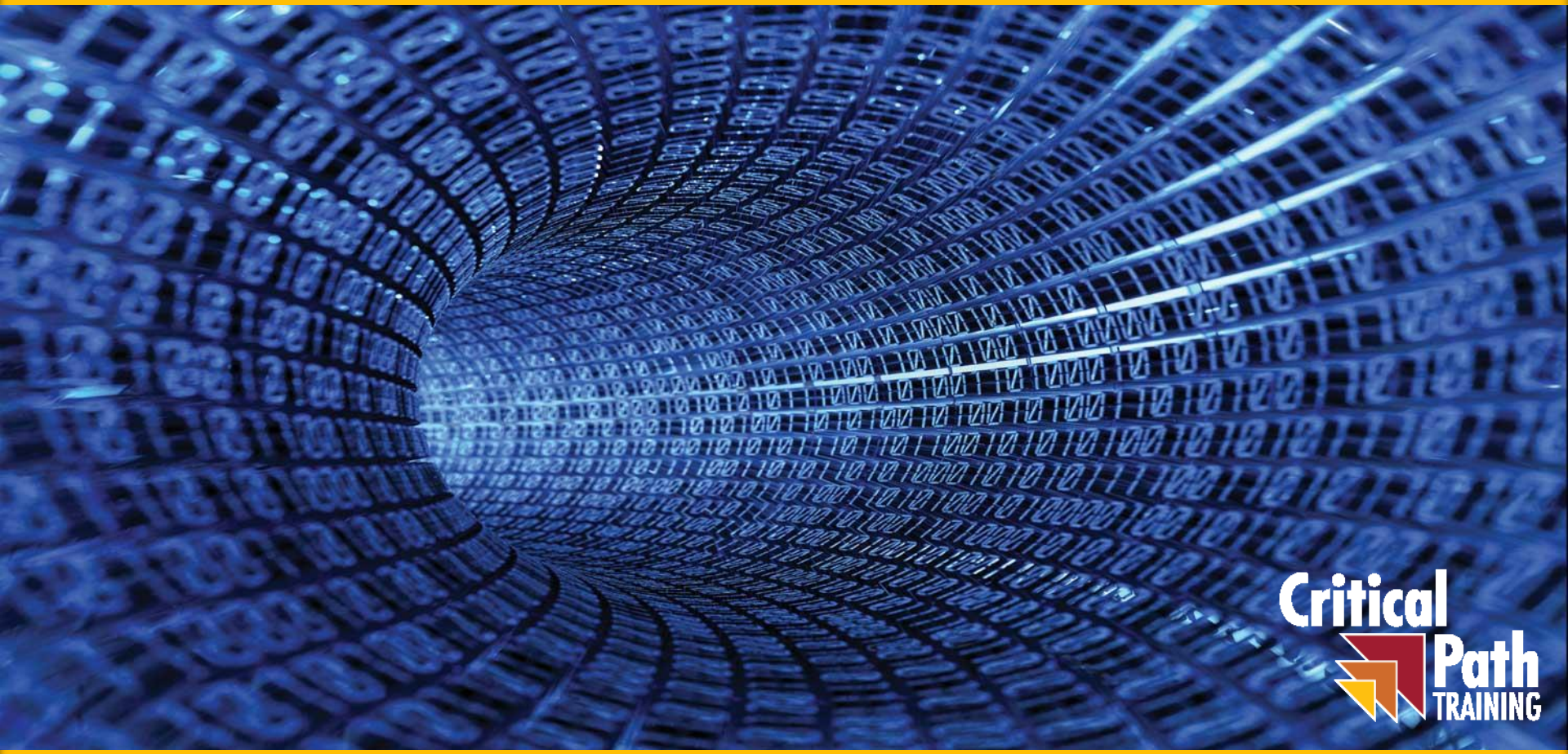
Working with Power BI Dataflows

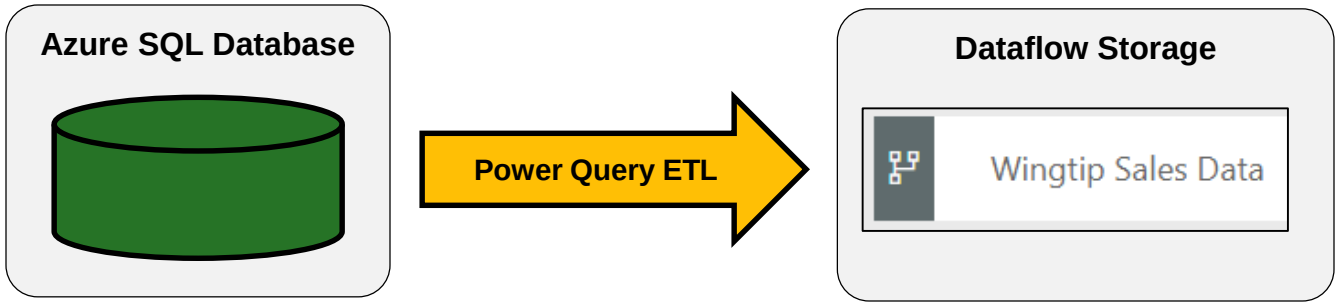


Agenda

- Understanding Dataflow Architecture
- Creating and Consuming Dataflows
- Creating a Star Schema
- Importing and Exporting Dataflows
- Using Premium Dataflow Features

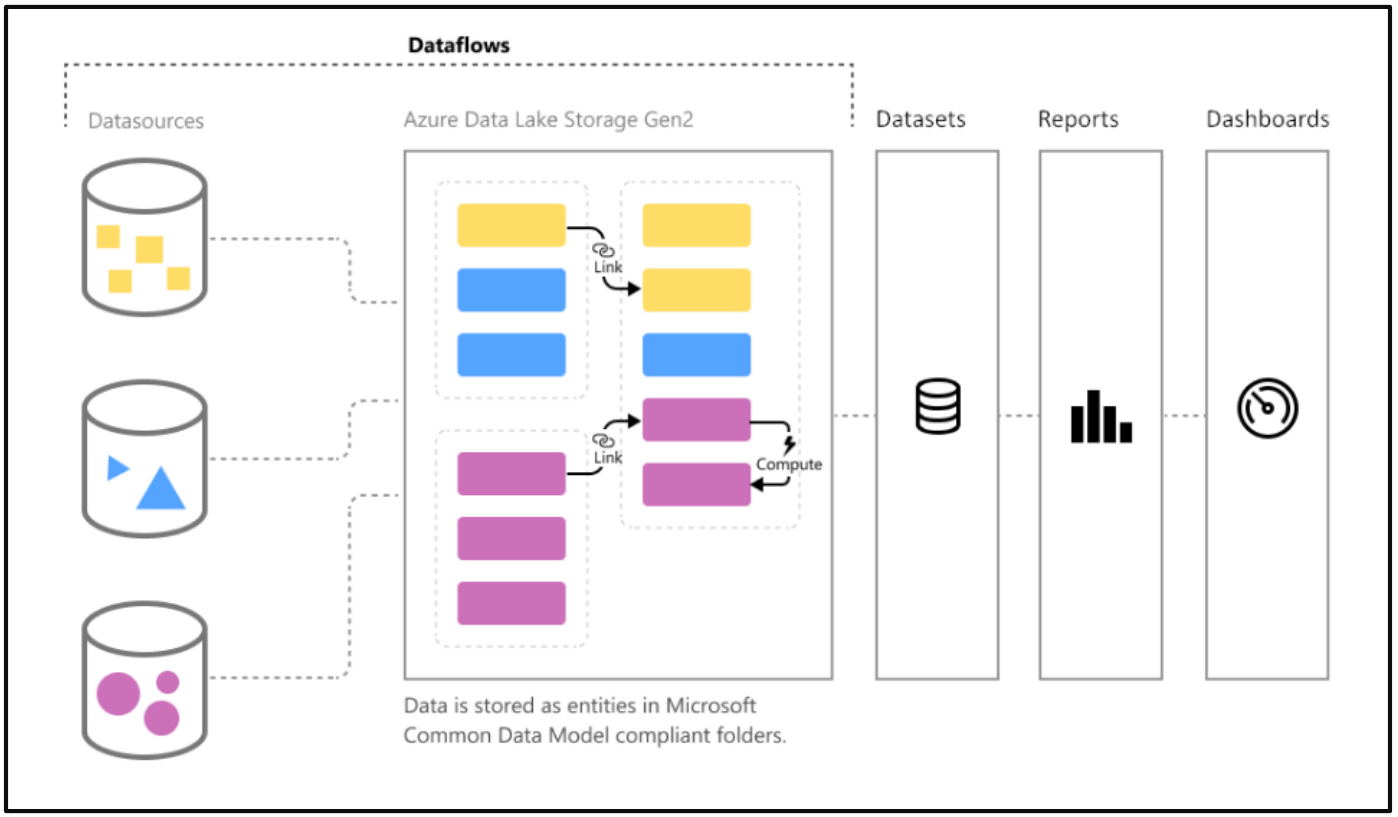
Motivation for Dataflows

- Dataflows provide self-service ETL that scales
  - Intuitive and familiar authoring using Power Query
  - Seamless integration with Power BI Desktop
  - Dataflow storage designed for interoperability & big data
  - Data storage format based on Common Data Model



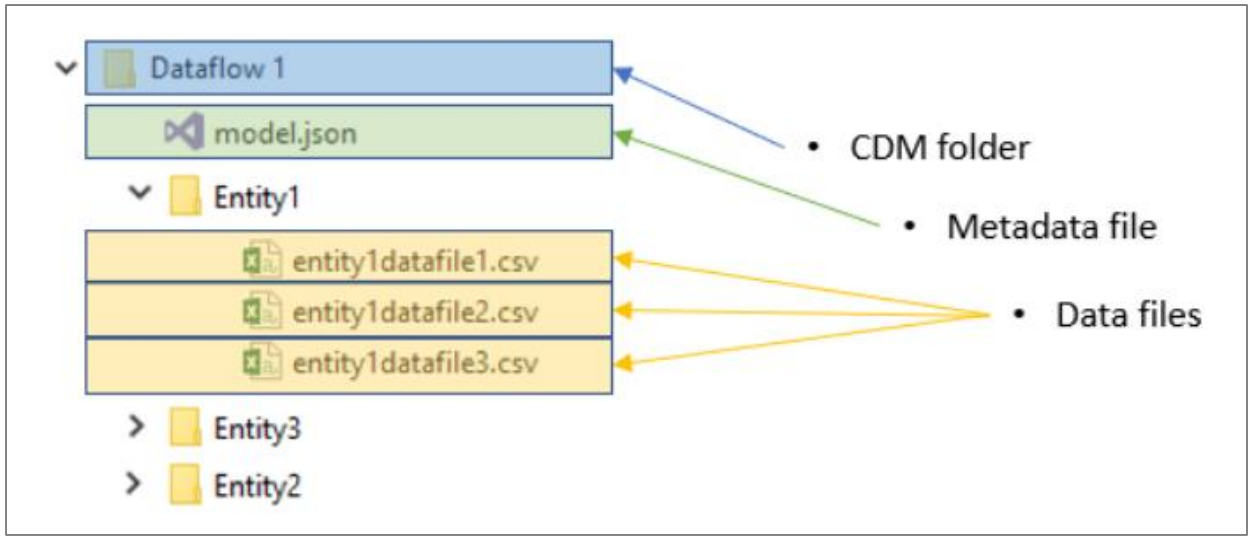
Dataflow Architecture

- Dataflows use Azure Data Lake Gen2 Storage
  - Storage designed to meet requirements of big data
  - Dataflows serialized in format defined by Common Data Model (CDM)



Dataflow Storage Details

- Serialization format is defined by the Common Data Model specification
  - Dataflow metadata stored in **model.json** file
  - Dataflow data rows stored in CSV files
  - By default, Power BI manages dataflow storage behind the scenes
- Dataflows can be configured to write data to Azure storage account
  - Allows access to dataflows by service other than Power BI
  - Allows with an organization to store larger data volumes



Common Data Model Metadata

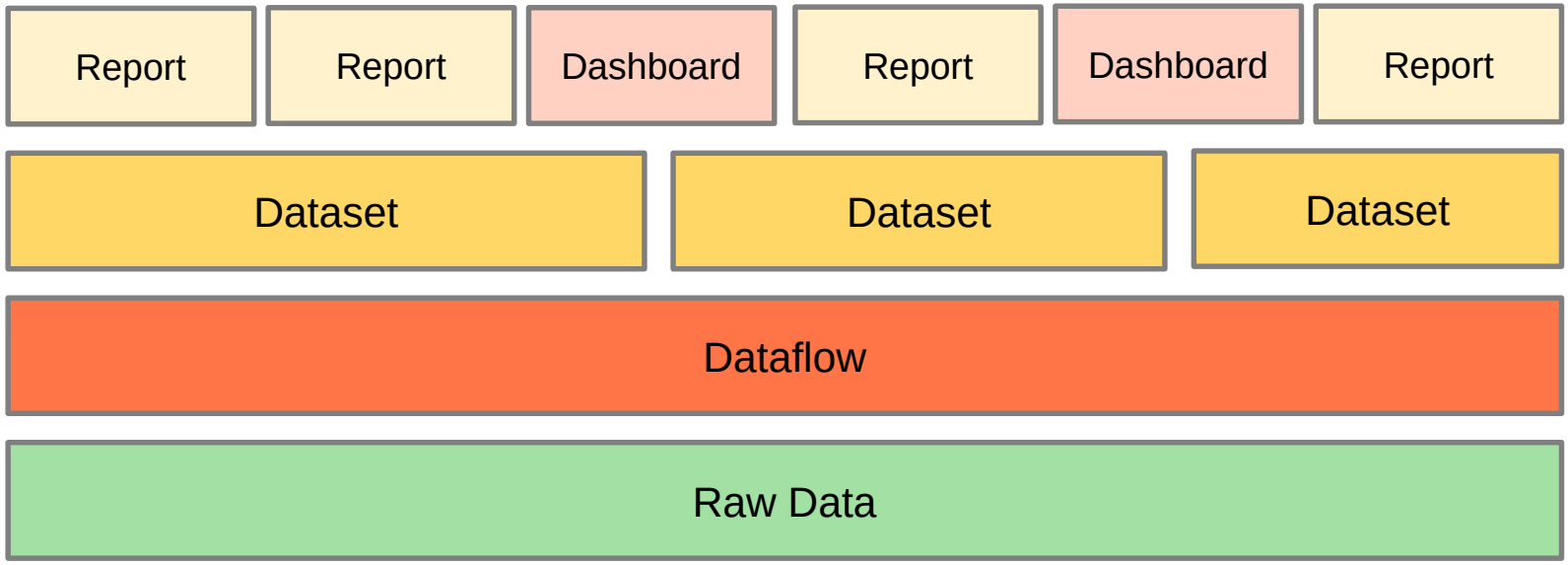
- Dataflow output is stored in CDM format
  - model.json file contains metadata about entities
  - model.json file contains M code for queries


```
{
    "name": "Wingtip Sales Dataflow",
    "description": "A sample dataflow",
    "version": "1.0",
    "culture": "en-US",
    "modifiedTime": "2019-10-21T17:54:50.1618626+00:00",
    "pbi:mashup": {
        "fastCombine": false,
        "allowNativeQueries": false,
        "queriesMetadata": {
            "Customers": { "queryId": "58d2a7e0-0298-4d94-8285-7af1f3d54b15", "
            "Products": { "queryId": "10577951-df4b-407c-b6fb-c923880ba1ed", "qu
            "Orders": { "queryId": "ad08816d-be0d-4f6f-b19e-755f23c8fb0f", "que
            "Sales": { "queryId": "4613190e-da33-4a3a-af5d-a567cbde4dd2", "query
        },
        "document": "section Section1;\r\nshared Customers = let\r\n  Source = 
    },
    "entities": [
        {
            "$type": "LocalEntity",
            "name": "Customers",
```

```
{ "$type": "LocalEntity", "name": "Products", "description": "",
  "pbi:refreshPolicy": { "$type": "FullRefreshPolicy", "location": "Products.csv" },
  "attributes": [
        { "name": "ProductId", "dataType": "int64" },
        { "name": "Product", "dataType": "string" },
        { "name": "Description", "dataType": "string" },
        { "name": "Category", "dataType": "string" },
        { "name": "Subcategory", "dataType": "string" },
        { "name": "UnitCost", "dataType": "decimal" },
        { "name": "ListPrice", "dataType": "decimal" },
        { "name": "Product Image", "dataType": "string" }
    ],
    "partitions": [
        {
            "name": "Part001",
            "refreshTime": "2019-10-21T17:59:55.5031318+00:00",
            "location": "https://wabieus2cdsap1.blob.core.windows.net:443/913b7aae-5
        }
    ]
},
```

Designing Power BI Solutions with Dataflows

- Dataflows used to collect all data
  - Power BI Desktop projects import data from dataflows
  - Complex ETL work no longer required in Power BI Desktop projects



Dataflow Benefits

- Replaces other ETL tools *(e.g. Azure Data Factory, Power Automate)*
- Decouples ETL work from datasets in PBIX projects
- Enable sharing of source tables of data between datasets
- Reduces number of queries on live data sources
- Eliminates need to connect user computers directly to data source
- Centralizes efforts to clean and prepare data
- Share tables that have no source (calendar tables)

Dataflow Disadvantages

- Adds extra complexity
- Data must be refreshed in 2 seperate phases
- Does not support data modelling features of DAX
- Some dataflow features require dedicated capacities

Licensing with Dataflows

- Dataflow creation requires Power BI Pro
  - Dataflows can only be created in app workspaces
  - Dataflows cannot be created in personal workspaces
- Dedicated capacity adds extra dataflow features
  - Ability to handle larger data volumes
  - Better refresh performance
  - Linked and computed entities
  - AI features to transform data

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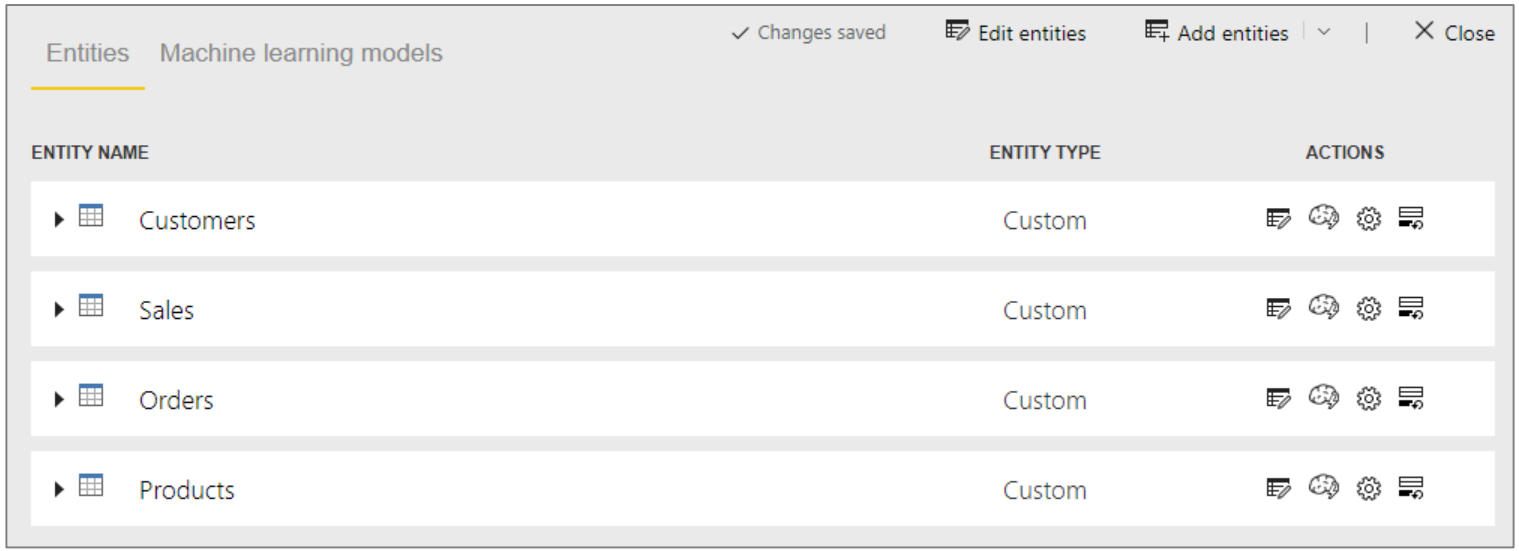
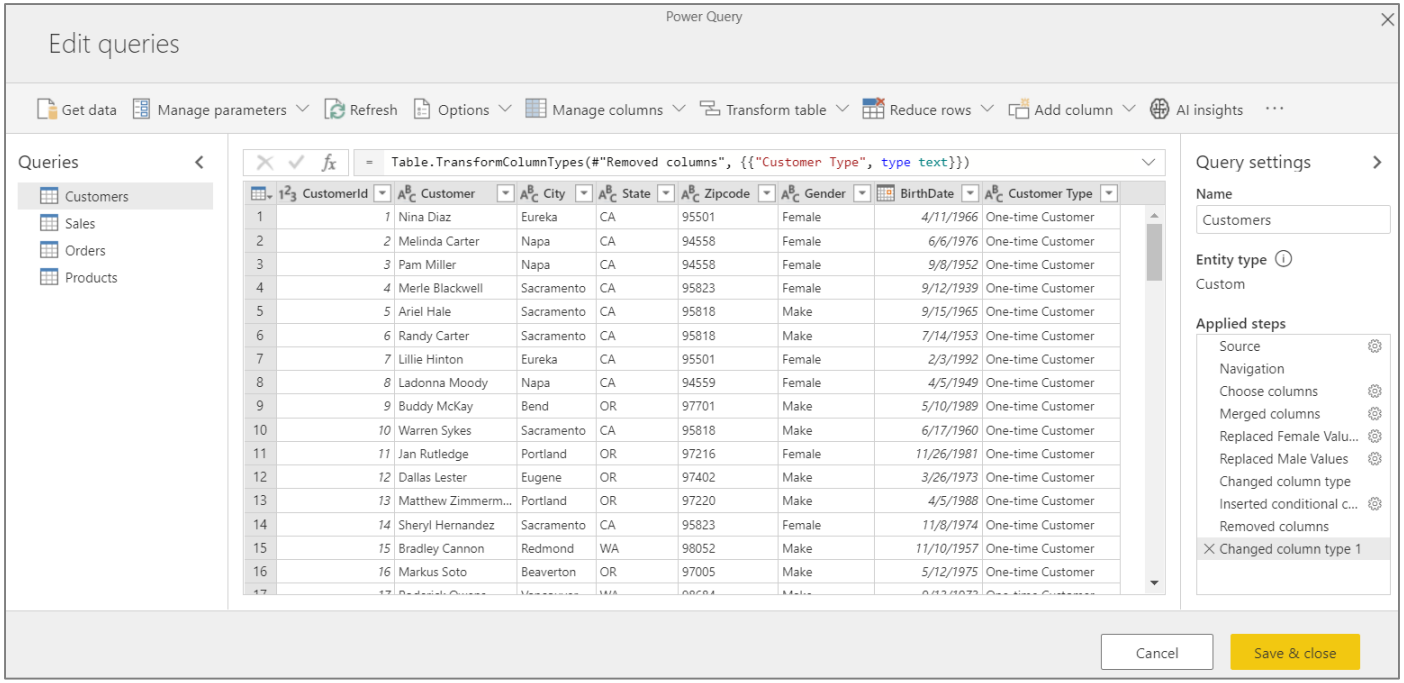
Dataflow Entities

- A **dataflow** exists within a workspace
  - Dataflow contains one or more **entities**
  - Entity is a table with well-defined schema
  - Entity data populated by running a query (M code)



Power Query in the Browser

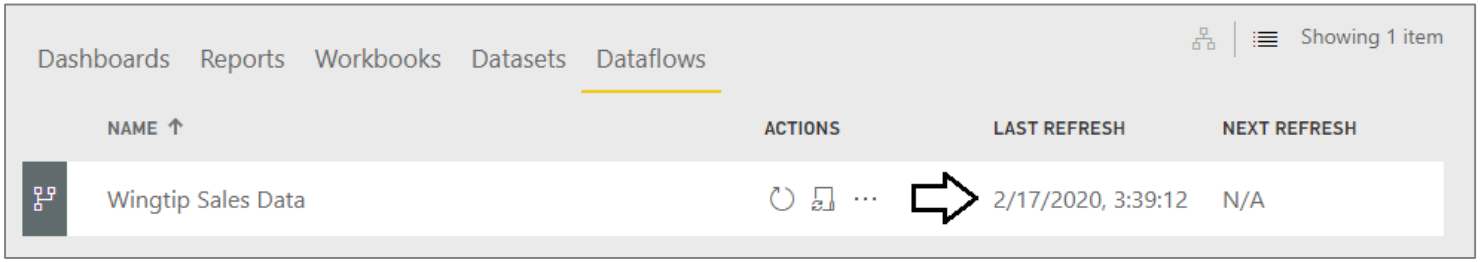
- Editing experience familiar to Power Query users



Refreshing a Dataflow

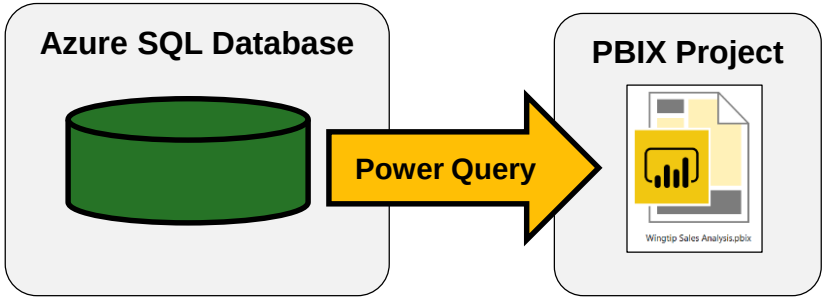
- Dataflow can be refreshed on demand or scheduled

- Dataflow displays last refresh time

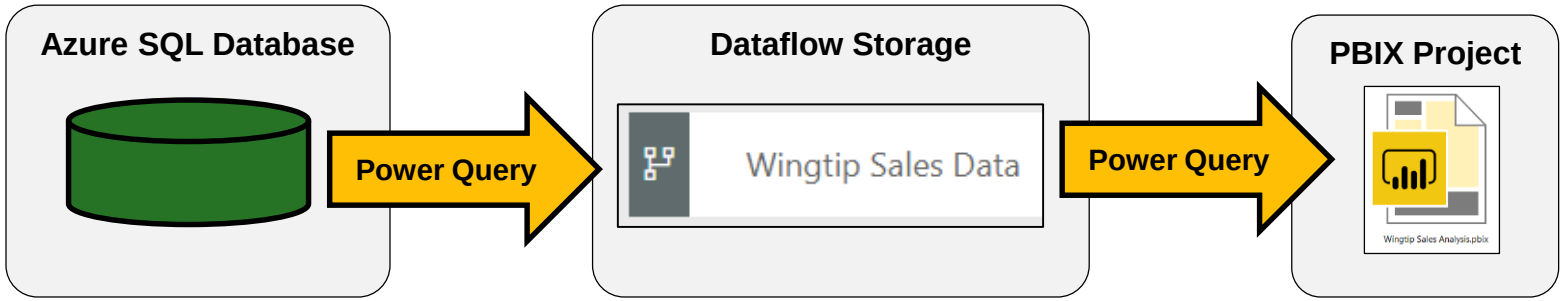


Dataflows and Power BI Desktop

- Power BI Desktop project without dataflow

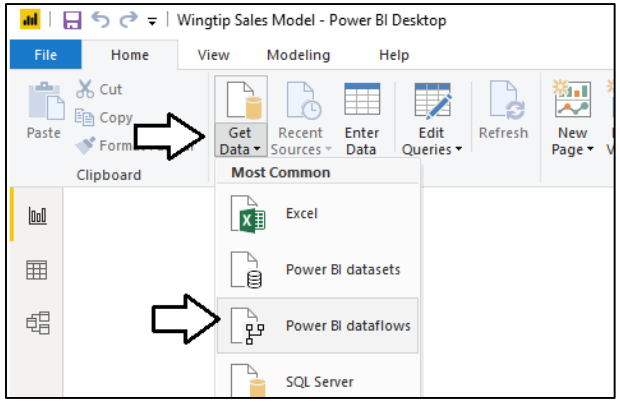


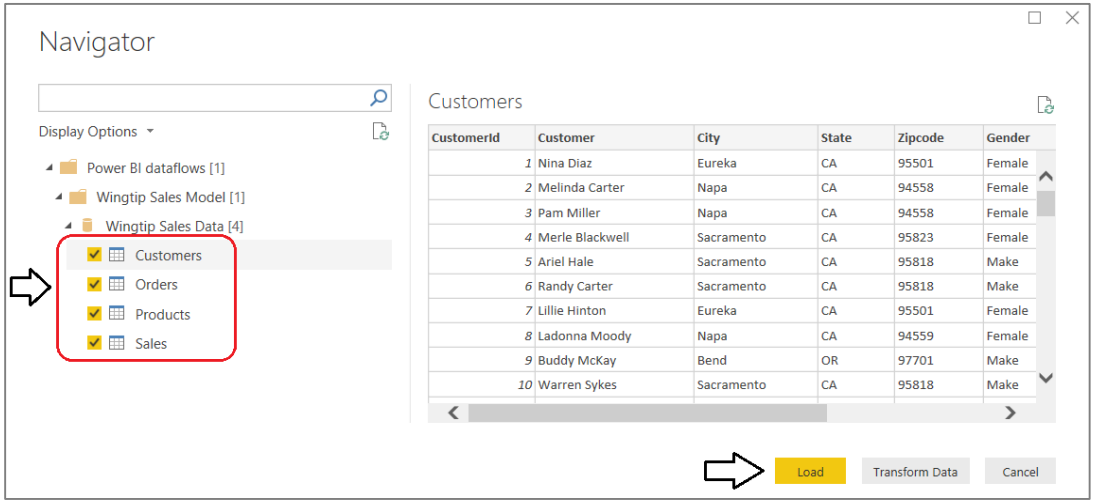
- Power BI Desktop project with dataflow



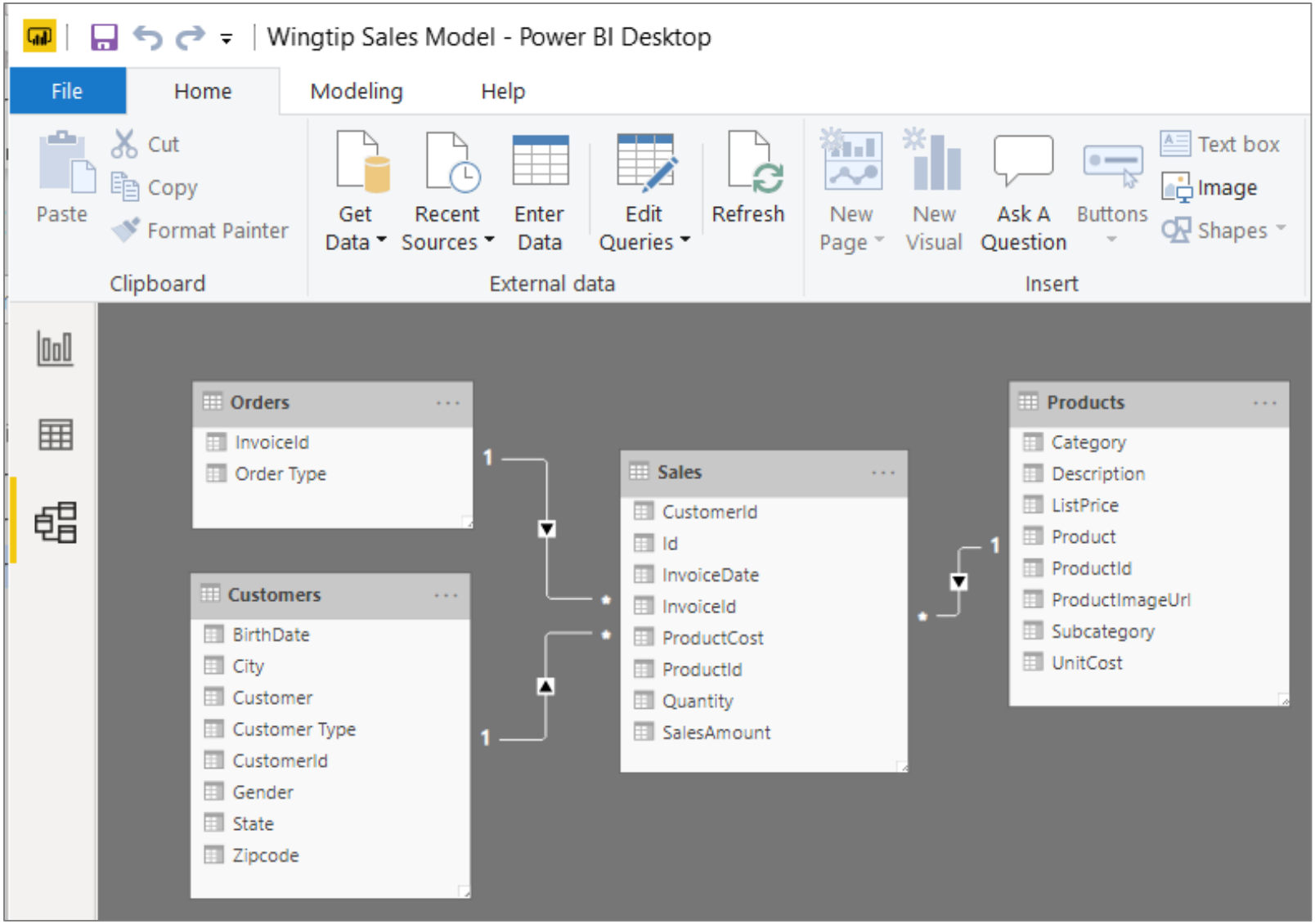
Consuming Dataflows

- Dataflow entities consumed by Power BI Desktop
  - Use **Power BI dataflows** data source
  - Dataset with dataflow can be published to any app workspace





Dataflow Provides Starting Point for Data Model



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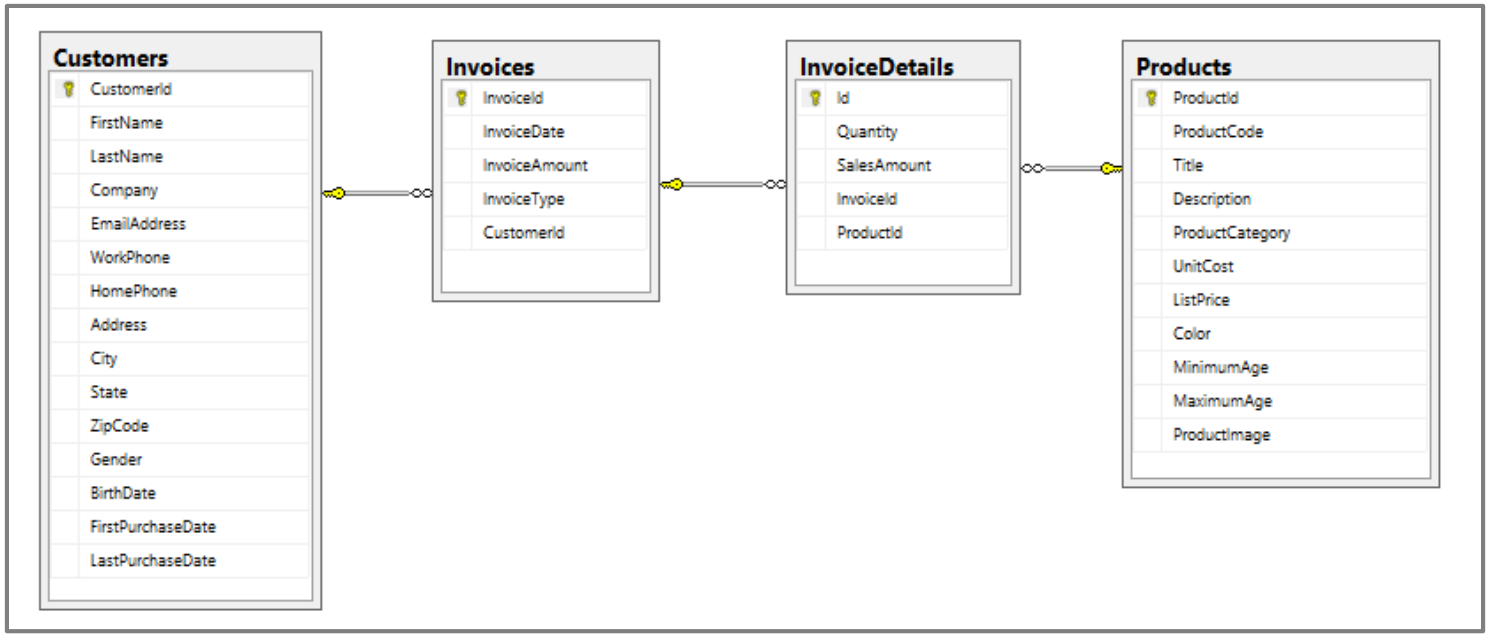
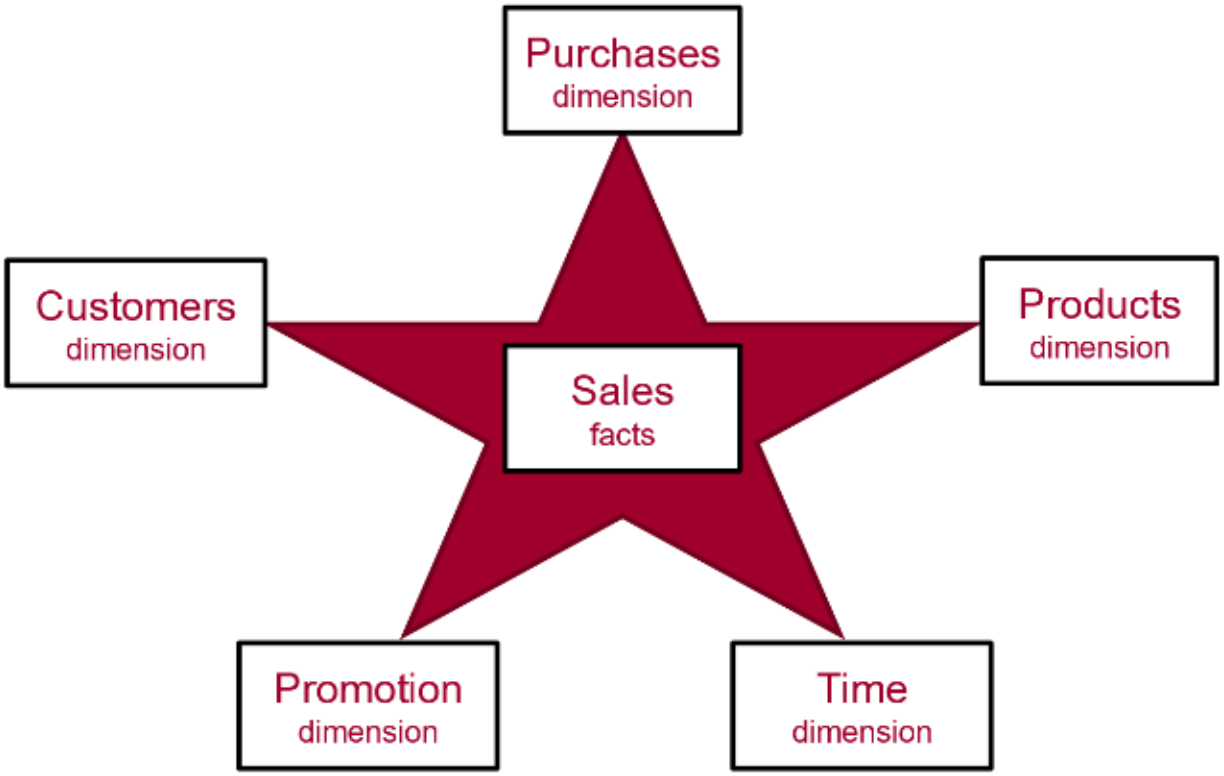
Sample OLTP Database: WingtipSalesDB

- Online Transaction Processing (OLTP) System
  - Used for real-time data access and transaction-based data entry
  - Optimized for faster transactions (e.g. inserts, updates & deletes)
  - Tables normalized to reduce/eliminate redundancies
  - Table schemas can be hard for business users to understand



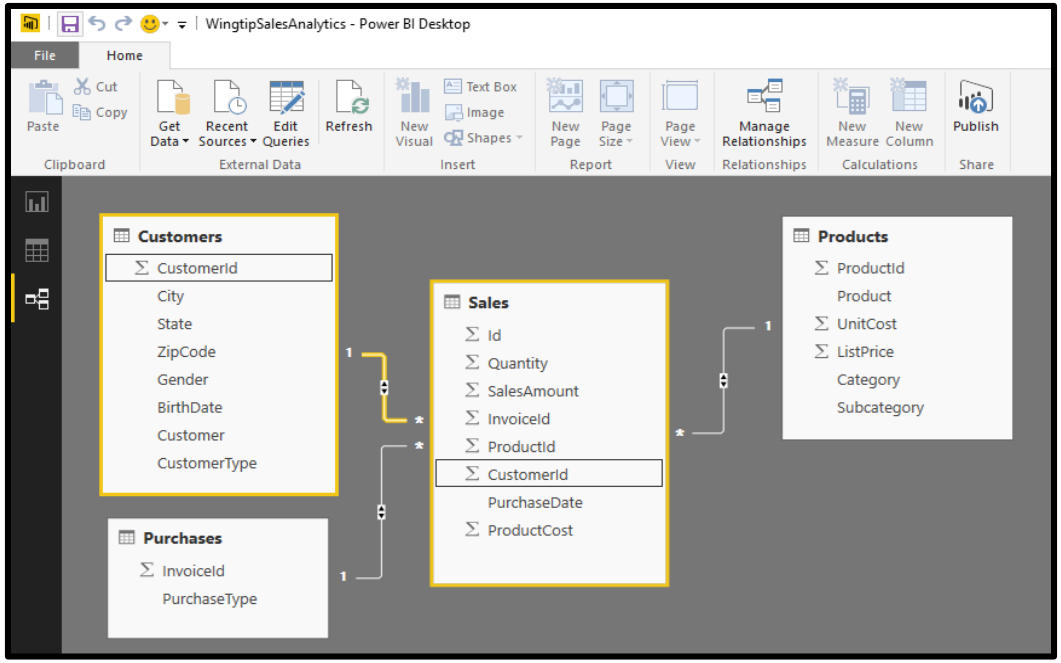
Data Modeling using a Star Schema

- OLAP Modeling often based on Star Schema
  - Tables defined as fact tables or dimension tables
  - Fact tables related to dimension table using 1-to-many relationships



Designing Queries to Build a Star Schema

- Converts OLTP Data Model to OLAP Data Model
  - Sales table is modeled as a OLAP Fact Table
  - Other tables are modeled as OLAP Dimension tables
  - Requires pulling CustomerId column into Sales table
  - All dimension tables should be directly related to fact table



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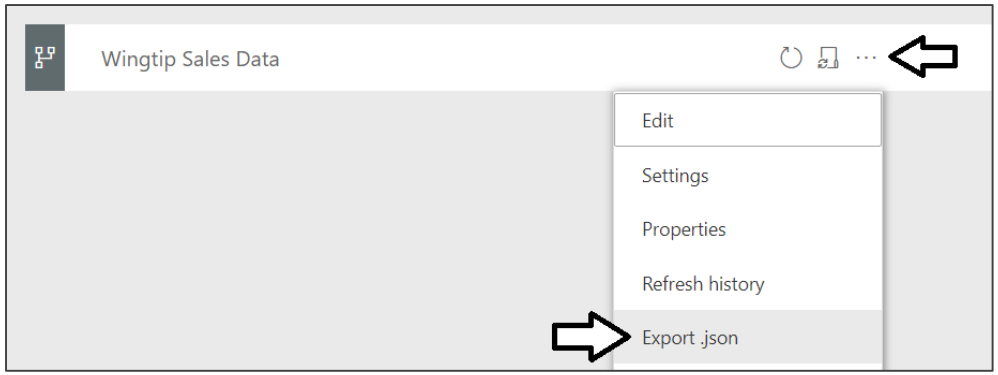
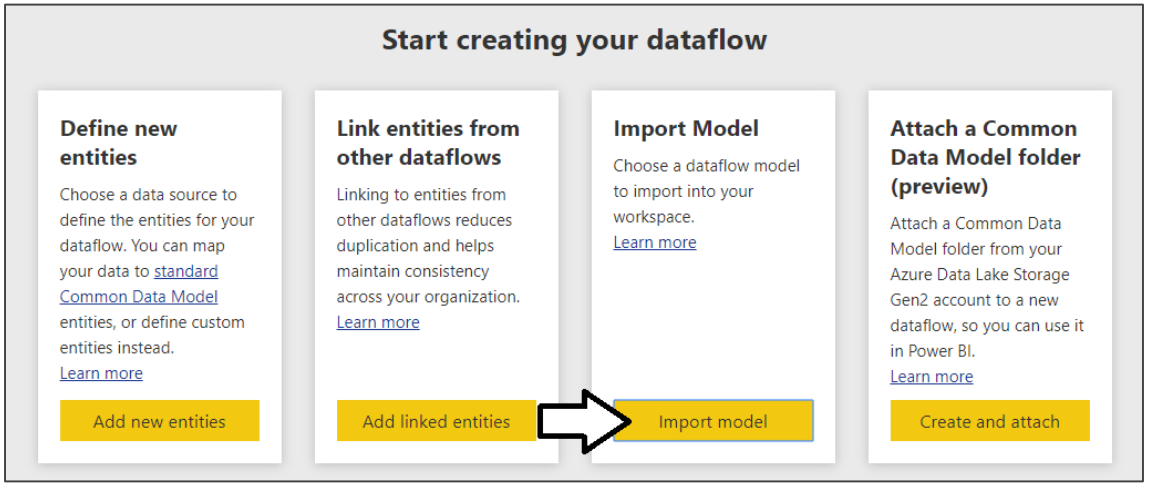
Importing and Exporting Dataflows

- Dataflow can be exported as model.json



- model.json can be imported to create new dataflow



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Dataflow Premium Features

- Linked entities
- Computed entities
- Artificial intelligence (AI) features
- Incremental refresh
- Parallel execution of transforms

Linked Entities

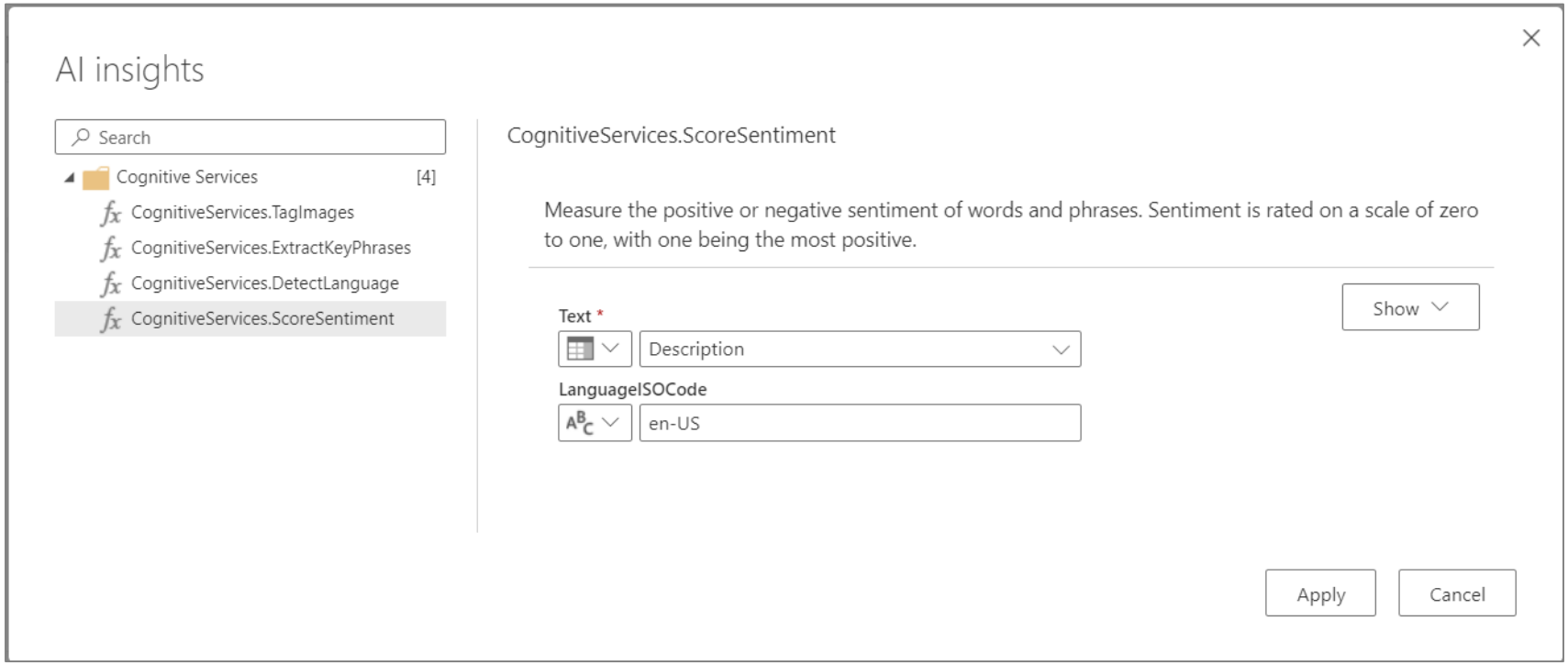
- Linked entities let you share data between
  - Different dataflows in the same Workspace
  - Different dataflows in different Workspaces
- Creating linked entity does not duplicate source data
  - You can use existing entity in another workspace as a source
  - Uses the same M code as dataset uses to get data from an entity
  - Linked entities are read-only
  - If you want further transformations you create computed entity
  - Diagram view makes it easy to see usage of linked entities

Computed Entities

- Computed entities built on to of other entities
  - Allows entities use other entities as data sources
  - Computed entity uses the persisted output of the source entity
- Useful scenarios
  - You are creating multiple entities within a dataflow from the same raw data, and don’t want to get data from the original data source more than once
  - You are hitting problems as a result of the Power Query engine’s habit of requesting data multiple times during a single query execution

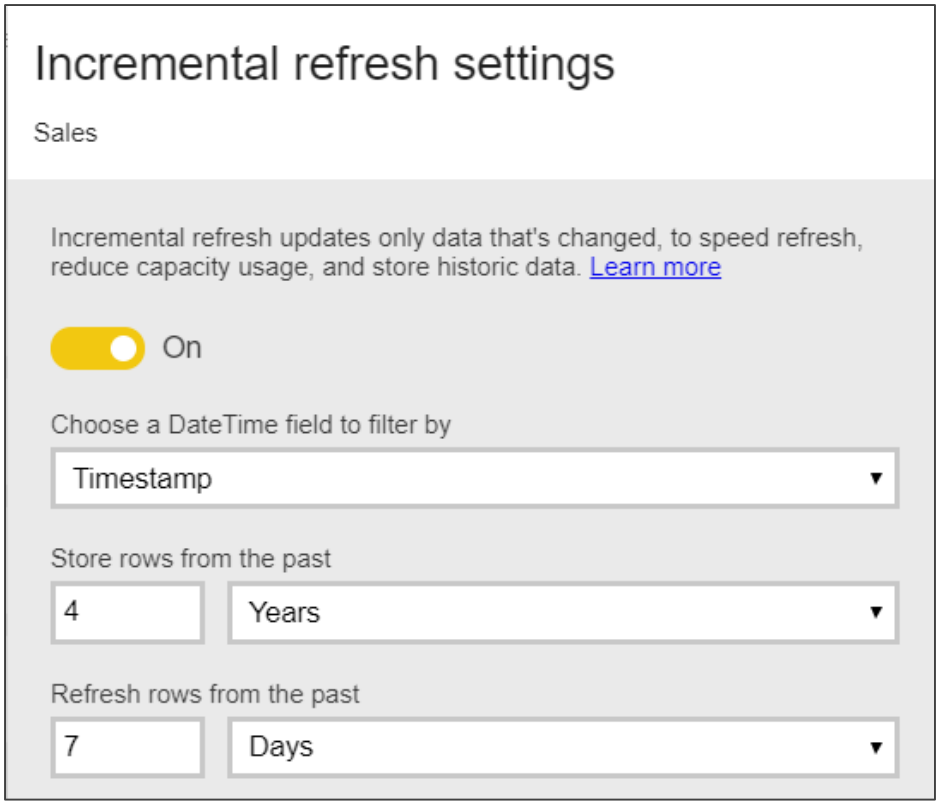
AI Features

- Dataflows in Power BI Premium includes AI features
  - Call Cognitive Services functions
  - Detect sentiment, language, tag images
  - Extract key phrases



Incremental Refresh

- Incremental refresh can be configured for entities
  - Very helpful to speed up refresh time for large tables



Summary

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