



TMDL, the new representation for semantic models

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Thank you!

- **Power BI & Fabric Manchester UG** team for organizing this event
- **Robert Walters** for sponsoring
- **All of you** to share your time with me
- **Alex Taylor** for inviting me

and...

I want to apologize in advance if my English won't be perfect

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BI Architect @ **Lucient**^{ITALIA}
+10 years in Microsoft “Data Realm”

Giving my little contribution to the community



DATA SATURDAYS

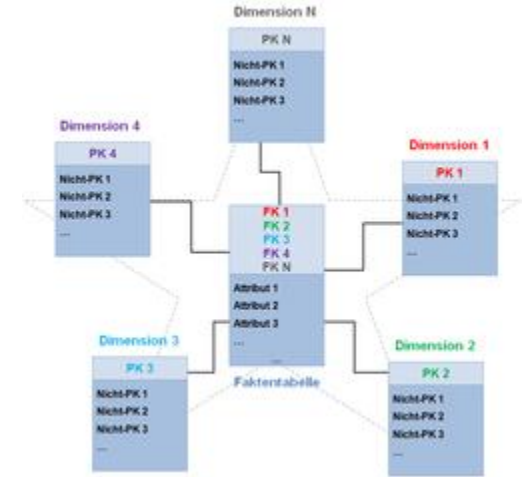
Dev>Marche

Agenda

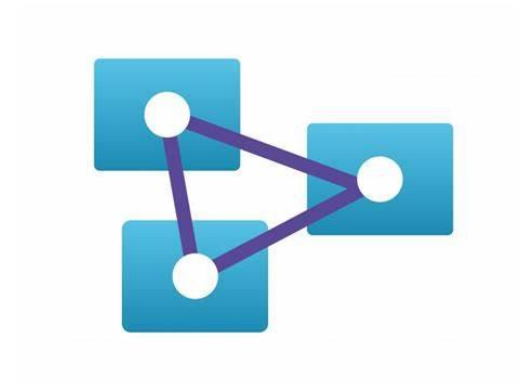
- Before TMDL
- What is TMDL?
- Tools supporting it
- TMDL for storing the model
- TMDL for managing the model
- Demos with no parachute

Semantic Models

- Terms used in Business Intelligence
- Close to the Business
- It's like an “hat” that define real world concepts
- Abstract the complexity of common OLTP models and multiple data sources



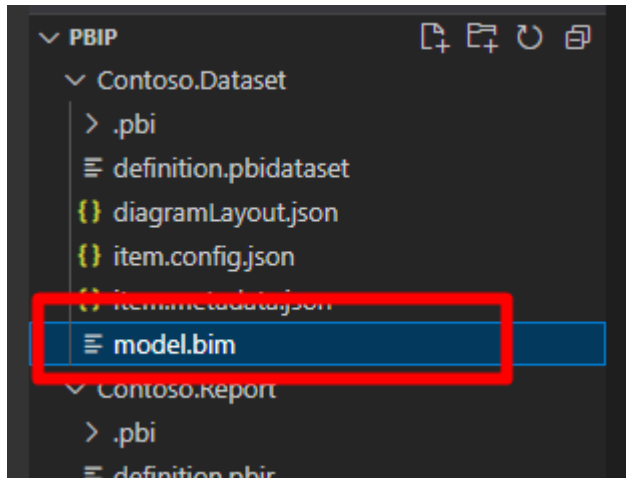
Microsoft's Semantic Models engines



Tabular Model Scripting Language (TMSL)*

```
{
  "description": "Tabular model definition at compatibility level 1200",
  "type": "object",
  "properties": {
    "name": {},
    "id": {},
    "description": {},
    "compatibilityLevel": {},
    "readWriteMode": {},
    "model": {
      "description": "Model object definition",
      "type": "object",
      "properties": {
        "name": {},
        "description": {},
        "storageLocation": {},
        "defaultMode": {},
        "defaultDataView": {},
        "culture": {},
        "collation": {},
        "annotations": {},
        "tables": {},
        "relationships": {},
        "dataSources": {},
        "perspectives": {},
        "cultures": {},
        "roles": {}
      },
      "additionalProperties": false
    }
  },
  "additionalProperties": false
}
```

* 1200 minimum required compatibility



```
},
"sourceQueryCulture": "en-US",
"tables": [
  {
    "name": "Channel",
    "annotations": [
      {
        "name": "ColumnsMetadata",
        "value": "{\\\"Columns\\\": [{\\\"Name\\\": \\\"Channel\\\"} ]}"
      },
      {
        "name": "PBI_ResultType",
        "value": "Table"
      }
    ]
  }
],
```

```
{
  "compatibilityLevel": 1550,
  "model": {
    "annotations": [
      {
        "name": "__PBI_TimeIntelligenceEnabled",
        "value": "1"
      },
      {
        "name": "PBIDesktopVersion",
        "value": "2.123.742.0 (23.11)"
      },
      {
        "name": "PBI_QueryOrder",
        "value": "[\\\"Channel\\\", \\\"Sales\\\", \\\"Stores\\\", \\\"Promotion\\\", \\\"Pro"
      },
      {
        "name": "PBI_ProTooling",
        "value": "[\\\"DevMode\\\"]"
      }
    ],
    "culture": "en-US",
    "cultures": [
      {
        "name": "en-US",
        "linguisticMetadata": {
          "content": {
            "DynamicImprovement": "HighConfidence",
            "Language": "en-US",
            "Version": "1.0.0"
          },
          "contentType": "json"
        }
      }
    ],
    "dataAccessOptions": {
      "legacyRedirects": true,
      "returnErrorValuesAsNull": true
    },
    "defaultPowerBIDataSourceVersion": "powerBI_V3",
    "relationships": [
      {
        "name": "4f81913b-9717-434b-944d-0fe871897062",
        "crossFilteringBehavior": "bothDirections",
        "fromColumn": "PromotionKey",
        "fromTable": "Sales",
        "toColumn": "PromotionKey",
        "toTable": "Promotion"
      },
      {
        "name": "d219834a-6b75-4cb0-0000-000000000000",
        "crossFilteringBehavior": "t",
        "fromColumn": "GeographyKey",
        "fromTable": "Stores",
        "toColumn": "GeographyKey",
        "toTable": "Geography"
      }
    ],
    "let",
    {
      "name": "Source = Access.Database(File.Contents(\\\"C:\\\\Users\\owend\\Documents\\ContosoSalesV31_64bit.accdb\\\")),",
      "_FactSales = Source[\\\"Schema=\\\", \\\"Item=\\\"FactSales\\\"]\\\"[Data],",
      "#\\\"Removed Columns\\\" = Table.RemoveColumns(_FactSales, \\\"CurrencyKey\\\", \\\"ETLLoadID\\\", \\\"LoadDate\\\", \\\"UpdatedDate\\\"))",
      "in",
      "#\\\"Removed Columns\\\""
    ],
    "type": "m"
  }
},
```

```
"columns": [
  {
    "name": "Channel",
    "annotations": [
      {
        "name": "SummarizationSetBy",
        "value": "Automatic"
      }
    ],
    "dataType": "int64",
    "formatString": "0",
    "isHidden": true,
    "lineageTag": "8cb0c47f-bda0-47c5-8d4f-35b1a1a1acfc",
    "sourceColumn": "Channel",
    "summarizeBy": "none"
  },
  {
    "name": "ChannelName",
    "annotations": [
      {
        "name": "SummarizationSetBy",
        "value": "Automatic"
      }
    ],
    "dataType": "string",
    "lineageTag": "bfa7d98d-f9c0-4aa6-80c0-937003093555",
    "sourceColumn": "ChannelName",
    "summarizeBy": "none"
  }
],
```

```
"measures": [
  {
    "name": "Sales",
    "annotations": [
      {
        "name": "PBI_FormatHint",
        "value": "{\\\"currencyCulture\\\": \\\"en-US\\\"}"
      }
    ],
    "expression": "sum(Sales[SalesAmount])",
    "formatString": "\\\"$#,0.#####\\\";\\\"$#,0.#####\\\";\\\"$#,0.#####\\\"",
    "lineageTag": "d5bcc404-e414-4faa-8f24-fa7c3b11b43d"
  }
],
```

```
"let",
"Source = Access.Database(File.Contents(\\\"C:\\\\Users\\owend\\Documents\\ContosoSalesV31_64bit.accdb\\\")),",
"_FactSales = Source[\\\"Schema=\\\", \\\"Item=\\\"FactSales\\\"]\\\"[Data],",
"#\\\"Removed Columns\\\" = Table.RemoveColumns(_FactSales, \\\"CurrencyKey\\\", \\\"ETLLoadID\\\", \\\"LoadDate\\\", \\\"UpdatedDate\\\"))",
"in",
"#\\\"Removed Columns\\\"",
],
"type": "m"
```


TMSL weaknesses

- JSON based
 - Verbose
 - Difficult to read
 - Even worse to edit
- One single file
 - changes are all on the same file
 - No good for DevOps

Tabular Model Definition Language (TMDL)*

- YAML-style
 - Fewer text, delimiters, indentation for parent-child relationship
 - Better reading
 - Better editing
- Multiple files structure
 - Each object its own file
 - DevOps hurray!

* 1200 minimum required compatibility (SQL server 2016 and above)

> Sales & Returns Sample v201912.Report
v Sales & Returns Sample v201912.SemanticModel
 > .pbi
 v definition
 > cultures
 v tables
 % Return Rate.tmdl
 Age.tmdl
 Analysis DAX.tmdl
 Associated Product.tmdl
 Association.tmdl
 Calendar.tmdl
 Customer.tmdl
 DataTableTemplate_81b13e4d-a259-4d50-a0e1-...
 Design DAX.tmdl
 Details.tmdl
 Issues and Promotions.tmdl
 LocalDataTable_d9fbe243-4814-4038-8eec-593e...
 Product.tmdl
 Sales.tmdl
 STable.tmdl
 Store.tmdl
 Tooltip Info.tmdl
 Tooltip Info2.tmdl
 database.tmdl
 model.tmdl
 relationships.tmdl
 .platform
 definition.pbism
 {} diagramLayout.json
 .gitignore
 Sales & Returns Sample v201912.pbin

```
model Model
```

```
  culture: en-US
```

```
  defaultPowerBIDataSourceVersion: powerBI_V3
```

```
  sourceQueryCulture: es-MX
```

```
  dataAccessOptions
```

```
    legacyRedirects
```

```
    returnErrorValuesAsNull
```

```
annotation __PBI_TimeIntelligenceEnabled = 1
```

```
annotation PBIDesktopVersion = 2.138.782.0 (24.11)
```

```
annotation PBI_QueryOrder = ["Association","Sales","Store","Calendar","Associate
```

```
annotation PBI_ProTooling = ["DevMode"]
```

```
ref table Association
```

```
ref table DataTableTemplate_81b13e4d-a259-4d50-a0e1-7a39807f5f63
```

```
ref table Sales
```

```
ref table Store
```

```
ref table Calendar
```

```
ref table LocalDataTable_d9fbe243-4814-4038-8eec-593e864a563b
```

```
ref table 'Associated Product'
```

```
ref table 'Analysis DAX'
```

```
ref table Product
```

```
ref table 'Design DAX'
```

```
ref table '% Return Rate'
```

```
ref table Customer
```

```
ref table 'Issues and Promotions'
```

```
ref table Age
```

```
ref table STable
```

```
ref table 'Tooltip Info'
```

```
ref table 'Tooltip Info2'
```

```
ref table Details
```

```
ref cultureInfo en-US
```

```
table Customer
```

```
  lineageTag: a5974167-47c2-4f10-851b-a9b36245bddd
```

```
  column ID
```

```
    dataType: int64
```

```
    formatString: 0
```

```
    lineageTag: 3b7be8e0-e042-4490-b32e-65973b81ec20
```

```
    summarizeBy: none
```

```
    sourceColumn: ID
```

```
    annotation SummarizationSetBy = Automatic
```

```
  column Unit
```

```
    dataType: int64
```

```
    formatString: 0
```

```
    lineageTag: 46ab0a74-2701-4599-a92a-8bda599ad70b
```

```
    summarizeBy: sum
```

```
    sourceColumn: Unit
```

```
    annotation SummarizationSetBy = Automatic
```

```
  column Gender
```

```
    dataType: string
```

```
    lineageTag: e5478605-21a7-493d-ac01-0becf9263db3
```

```
    summarizeBy: none
```

```
    sourceColumn: Gender
```

```
    annotation SummarizationSetBy = Automatic
```

```
column Amount
```

```
  dataType: int64
```

```
  formatString: \$,0;- \$,0; \$,0
```

```
  lineageTag: 0f3e8104-04cc-4713-b482-7a1f94571269
```

```
  summarizeBy: sum
```

```
  sourceColumn: Amount
```

```
  annotation SummarizationSetBy = Automatic
```

```
  annotation PBI_FormatHint = {"currencyCulture":"en-CA"}
```

Table.tmdl Power Query

```
partition Customer-7e8cffbe-9644-4d2a-9653-8804b02c15eb = m
mode: import
source =
    let
        Source = Excel.Workbook(File.Contents("C:\Users\mimyersm\Desktop\Sales & Marketing Datas.xlsx"), null, true),
        Data_Sheet = Source[[Item="Data",Kind="Sheet"]][Data],
        #"Promoted Headers" = Table.PromoteHeaders(Data_Sheet, [PromoteAllScalars=true]),
        #"Changed Type" = Table.TransformColumnTypes(#"Promoted Headers",{{"ID", Int64.Type}, {"ProductID", Int64.Type}, {"StoreID", Int64.Type}, {"Unit", Int64.Type}},),
        #"Removed Columns" = Table.RemoveColumns(#"Changed Type",{ "Status"}),
        #"Merged Queries" = Table.NestedJoin(#"Removed Columns", {"ProductID"}, Product, {"ProductID"}, "Product", JoinKind.LeftOuter),
        #"Expanded Product" = Table.ExpandTableColumn(#"Merged Queries", "Product", {"Product", "Category", "Segment", "Price", "Price Range"}, {"Product.1", "Category.1", "Segment.1", "Price.1", "Price Range.1"}),
        #"Renamed Columns" = Table.RenameColumns(#"Expanded Product",{{"Product.1", "Product"}},),
        #"Removed Columns1" = Table.RemoveColumns(#"Renamed Columns",{ "ProductID"}),
        #"Replaced Value" = Table.ReplaceValue(#"Removed Columns1", "M", "Male", Replacer.ReplaceText, {"Gender"}),
        #"Replaced Value1" = Table.ReplaceValue(#"Replaced Value", "F", "Female", Replacer.ReplaceText, {"Gender"}),
        #"Merged Queries1" = Table.NestedJoin(#"Replaced Value1", {"StoreID"}, Store, {"StoreID"}, "Store", JoinKind.LeftOuter),
        #"Expanded Store" = Table.ExpandTableColumn(#"Merged Queries1", "Store", {"Store", "Type"}, {"Store.1", "Type"}),
        #"Renamed Columns1" = Table.RenameColumns(#"Expanded Store",{{"Store.1", "Store"}},),
        #"Merged Queries2" = Table.NestedJoin(#"Renamed Columns1", {"ID"}, #"Issues and Promotions", {"ID"}, {"ID"}, JoinKind.LeftOuter),
        #"Removed Columns2" = Table.RemoveColumns(#"Merged Queries2",{ "StoreID"}),
        #"Expanded Issues and Promotions" = Table.ExpandTableColumn(#"Removed Columns2", "Issues and Promotions", {"Issue", "Promotion"}, {"Issue", "Promotion"}),
        #"Removed Columns3" = Table.RemoveColumns(#"Expanded Issues and Promotions",{ "Week"}),
        #"Merged Queries3" = Table.NestedJoin(#"Removed Columns3", {"ID"}, Sales, {"ID"}, "Sales", JoinKind.LeftOuter),
        #"Expanded Sales" = Table.ExpandTableColumn(#"Merged Queries3", "Sales", {"Amount"}, {"Amount"}),
        #"Merged Queries4" = Table.NestedJoin(#"Expanded Sales", {"Age"}, Age, {"Age"}, "Age.1", JoinKind.LeftOuter),
        #"Expanded Age.1" = Table.ExpandTableColumn(#"Merged Queries4", "Age.1", {"Age Bucket"}, {"Age Bucket"}),
        #"Removed Columns4" = Table.RemoveColumns(#"Expanded Age.1",{ "Age"}),
        #"Renamed Columns2" = Table.RenameColumns(#"Removed Columns4",{{"Age Bucket", "Age"}},),
        #"Removed Columns5" = Table.RemoveColumns(#"Renamed Columns2",{ "Price"}),
    in
        #"Removed Columns5"

annotation PBI_QueryRelationships = {"columnCount":13,"keyColumnNames":[],"queryRelationships":[{"keyColumnCount":1,"keyColumn":0,"otherKeyColumnIdentity":"Section1/Issues and Promotions"}]}

annotation PBI_NavigationStepName = Navigation

annotation PBI_ResultType = Exception
```

Table.tmdl DAX

```
table 'Analysis DAX'  
    lineageTag: 445c1cb0-47b0-4e8b-986b-300a640b0447  
  
    measure 'Net Sales' = CALCULATE(SUM(Sales[Amount]),Sales[Status]="Sold")  
        formatString: \$,0;- \$,0; \$,0  
        lineageTag: cd2e7756-eb39-41a6-a73c-36aecb7b43c8  
  
        annotation PBI_FormatHint = {"currencyCulture":"en-CA"}  
  
    measure 'Net Sales PM' = CALCULATE([Net Sales],PREVIOUSMONTH('Calendar'[Date]))  
        formatString: \$,0;- \$,0; \$,0  
        lineageTag: b71875ff-9152-49a3-9651-654f7beb05e9  
  
        annotation PBI_FormatHint = {"currencyCulture":"en-CA"}  
  
    measure 'Last 2 Months Net Sales' = [Net Sales]+[Net Sales PM]  
        formatString: 0  
        lineageTag: 476b56d5-ccb7-4f18-a60a-d1ed841caaf7  
  
    measure 'Net Sales Variance' = [Net Sales]-[Net Sales PM]  
        formatString: \$,0;- \$,0; \$,0  
        lineageTag: ea94c27a-07f9-4dcb-9c51-33ecf46a07b2  
  
        annotation PBI_FormatHint = {"currencyCulture":"en-CA"}
```

Relationships.tmdl

```
relationship a3dbf965-d829-4162-96fc-d8c4a82aaefc  
  fromColumn: Sales.Date  
  toColumn: Calendar.Date
```

```
relationship bd728e6c-e5e7-4b83-98c6-677efdcc0eb6  
  crossFilteringBehavior: bothDirections  
  fromCardinality: one  
  fromColumn: Customer.ID  
  toColumn: Sales.ID
```

```
relationship fc9659a9-cbb8-4acb-9331-54826be4ab0a  
  fromColumn: Association.LeftItemSetId  
  toColumn: Product.ProductID
```

```
relationship 5fb6421a-c1c5-4969-95e5-0939e04d5c72  
  isActive: false  
  crossFilteringBehavior: bothDirections  
  fromCardinality: one  
  fromColumn: Product.Product  
  toColumn: 'Associated Product'.Product
```

Tools supporting TMDL

Full support



Basic support



No support



Demo Time

links

- [Tabular Model Scripting Language \(TMSL\) Reference | Microsoft Learn](#)
- [Tabular Model Definition Language \(TMDL\) | Microsoft Learn](#)
- [TMDL - Visual Studio Marketplace](#)
- <https://medium.com/riccardo-perico/from-ssas-tabular-to-power-bi-semantic-model-at-the-speed-of-light-6b25e1b1f710>

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Giving my little contribution to the community



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Thanks