



# Denodo MDX Service User Manual

Revision 20231215

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## 1 OVERVIEW

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This component allows exposing Virtual DataPort databases as OLAP cubes, previously defined using a logical schema. It supports the MDX (multidimensional expressions) query language and the XMLA (XML for Analysis) format. It is useful for dimensional data exploration — for example analyzing sales by product line, by region or by time period.

MDX (MultiDimensional eXpressions) is a query language for Online Analytical Processing (OLAP). It allows querying the multidimensional data stored in OLAP Cubes.

**The Denodo MDX Service is a customization of the open source Mondrian (R)OLAP engine created by Pentaho**, including a limited set of additional features

that allow data to be extracted from Denodo Virtual DataPort using the VQL query language, and authentication to work in an integrated way.

## 2 INSTALLATION AND CONFIGURATION

---

The Denodo MDX Service is distributed as a DenodoConnect that can be downloaded from the Support site.

This Denodo MDX Service distribution consists of:

- Command-line executable scripts for Windows and Linux (/bin folder)
- Configuration files: application.properties, mondrian.properties and log4j2.xml (/config folder)
- Java libraries (/lib folder)
  - Denodo MDX Service application jar: denodo-mdx-service-<version>-jar
  - Denodo driver jar: denodo-vdp-jdbcdriver-dist-<version>-full.jar  
If you need to use a JDBC driver corresponding to a Denodo update different to the one that is distributed, you only need to replace this jar.

For installing it just download the .zip file and extract the service into the desired folder.

In order to run it, you need at least Java 8 and the environment variables JAVA\_HOME and PATH correctly configured.

After running the script in the /bin folder, you can use the Denodo MDX Service from an XMLA client, using HTTP Basic Authentication or SPNEGO with Denodo-valid credentials.

Denodo XML Service runs at: `http://localhost:8087/xmla/<dbname>`

```

POST http://localhost:8087/xmla/foodmart

Params Authorization Headers (11) Body Pre-request Script Tests Settings
● none ● form-data ● x-www-form-urlencoded ● raw ● binary ● GraphQL Text ⚠

1 <?xml version="1.0" encoding="UTF-8"?>
2 <SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
3 <SOAP-ENV:Body>
4 <<Execute xmlns="urn:schemas-microsoft-com:xml-analysis" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
5 <<Command>
6 <<<Statement>
7 SELECT
8 NON EMPTY
9 <<<<CrossJoin(Hierarchize({[Customers].[City].Members, [Customers].[State Province].Members})
10 , <<<<Hierarchize({[Time.Weekly].[All].Members}))
11 DIMENSION PROPERTIES PARENT_UNIQUE_NAME
12 ON 0
13 , <<<<NON EMPTY
14 <<<<CrossJoin(Hierarchize({[Education Level].[All].Members, [Education Level].[Education Level].Members})
15 , <<<<Hierarchize({[Yearly Income].[Yearly Income].Members}))
16 DIMENSION PROPERTIES PARENT_UNIQUE_NAME
17 ON 1
18 FROM
19 [Sales]
20 <<<</Statement>
21 <<<</Command>
22 <<<</Properties>
23 <<<<<PropertyList> <<<<<<
24 <<<<<<Catalog>Foodmart</Catalog>
25 <<<<<<Format>Multidimensional</Format>
26 <<<<<<Content>SchemaData</Content>
27 <<<<<</PropertyList>
28 <<<</Properties>
29 <<<</Execute>
    
```

## 2.1 CONFIGURATION

The Denodo MDX Service allows you configure the following properties at the config/application.properties file:

```

server.port=8087
denodo.mdx.connection.jdbcurl=jdbc:vdb://localhost:19999/?noAuth=true
denodo.mdx.catalogs.<schema_id>.name=<SchemaName>
denodo.mdx.catalogs.<schema_id>.location=<SchemaLocation.xml>
    
```

- **server.port**: Port at which the MDX Service listens to HTTP requests. Default is **8087**.
- **denodo.mdx.connection.jdbcurl**: The database URI to access Denodo from the XML Service. Default is **jdbc:vdb://localhost:9999/?noAuth=true**. This URL should allow the absence of configured credentials by means of the noAuth=true parameter.
- **denodo.mdx.catalogs.\***: It is necessary to set Mondrian catalog schemas to be used for this instance. For each catalog schema to be configured into the service, both a name and the location of the schema file (XML) need to be specified. XML schema files are expected to follow Mondrian's schema format. At the end of this document there is a subsection about how to create a schema. To add a catalog you have to append an identifier to **denodo.mdx.catalogs**, before name and location. Example:

denodo.mdx.catalogs.someschema.name and  
denodo.mdx.catalogs.someschema.location.

- **denodo.mdx.catalogs.<schema\_id>.name:** Name of every catalog.
- **denodo.mdx.catalogs.<schema\_id>.location:** Schema locations are expected to be specified in one of two forms:
  1. As a path relative to the Denodo MDX Service's installation "/config" folder. For example, "schemas/SomeSchema.xml" would mean "\$DENODO\_MDX\_SERVICE\_HOME/config/schemas/SomeSchema.xml".
  2. As a local absolute file URL. For example "file:/home/users/mondrianuser/schemas/SomeSchema.xml"

### 2.1.1 Kerberos Configuration Authentication

Kerberos Authentication needs to be enabled in the file config/mondrian.properties. You have to configure the parameter mondrian.allow.kerberos.authentication to true. Uncomment the line that is in the file. Basic Authentication might not work with this parameter enabled.

## 2.2 CREATE SCHEMA

A multi-dimensional database can be defined by a logical model that consists in a set of cubes, hierarchies, and members mapping onto a physical model.

The schemas are represented in a XML file that contains cubes, dimensions, hierarchies, levels and members. The elements of the schema are linked to VDP views by means of Table elements in the schema specification. A example of a schema:

```
<Schema name="DenodoSales">
  <Cube name="SalesCube" visible="true" cache="false" enabled="true">
    <Table name="impala_store_sales">
    </Table>
    <Dimension type="StandardDimension" visible="true" foreignKey="ss_customer_sk"
highCardinality="false" name="Customer">
      <Hierarchy name="default" visible="true" hasAll="true" allMemberName="All
Customers" primaryKey="c_customer_sk">
        <Table name="oracle_customer">
        </Table>
        <Level name="Customer Country" visible="true" column="c_birth_country"
type="String" uniqueMembers="false" levelType="Regular" hideMemberIf="Never">
        </Level>
      </Hierarchy>
    </Dimension>
    <Measure name="Total" column="ss_net_paid" datatype="Numeric" aggregator="sum"
visible="true">
    </Measure>
  </Cube>
</Schema>
```

You can find the documentation about how to create schemas here:  
<https://mondrian.pentaho.com/documentation/schema.php>

In addition you can use Pentaho Schema Workbench to create the schema. This is a Java application that can help you design the Schema. There is an Appendix about this tool at the end of this document.

### 3 FEATURES

---

Denodo MDX Service provides:

- XMLA provider: XML for Analysis is a protocol that allows clients to interact with an OLAP server via SOAP messages.
- Parsing of the MDX language into VDP Query Language (VQL) to retrieve answers to dimensional queries.
- Authenticated connectivity to VDP using HTTP Basic Auth or Kerberos (SPNEGO).

### 4 QUERYING DATA

---

MDX is the query language used to access OLAP cubes. It is a standard language introduced by Microsoft with a different structure to that of SQL, and adapted to multidimensional structures.

A basic MDX query:

```
SELECT
[Measures].Members ON COLUMNS,
[Gender].Members ON ROWS
FROM [Sales]
```

There is a brief MDX tutorial at the Mondrian web site:  
<https://mondrian.pentaho.com/documentation/mdx.php>

The Denodo MDX service will accept XMLA requests, containing an MDX query. These XMLA requests will be sent in SOAP format via HTTP.

Below we can see an example, using Postman as a client to make the MDX query:

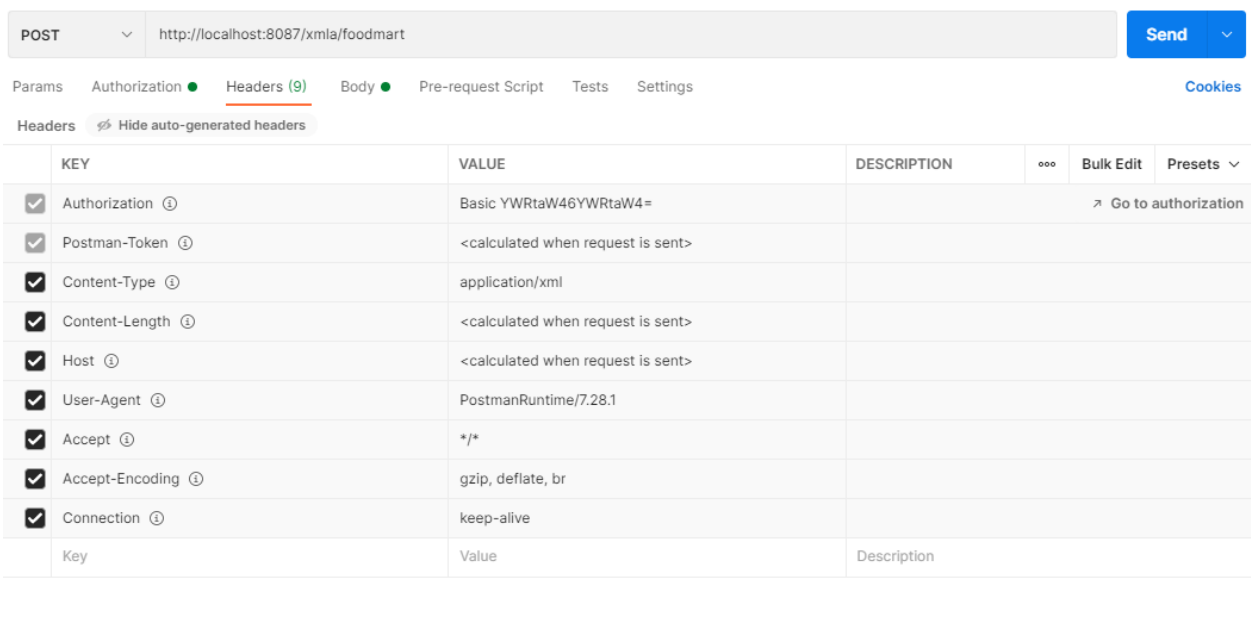
- The request type has to be POST
- Open the **Body** tab and check the data type for **raw**.
- Open the Content-Type selection box and select **XML**
- Enter your raw XMLA request data into the body:

```

<?xml version="1.0" encoding="UTF-8"?>
<SOAP-ENV:Envelope xmlns:SOAP-
ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-
ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
  <SOAP-ENV:Body>
    <Execute xmlns="urn:schemas-microsoft-com:xml-analysis" SOAP-
ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
      <Command>
        <Statement>
          SELECT
            [Measures].Members ON COLUMNS,
            [Gender].Members ON ROWS
          FROM [Sales]
        </Statement>
      </Command>
      <Properties>
        <PropertyList>
          <Catalog>Foodmart</Catalog>
        </PropertyList>
      </Properties>
    </Execute>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

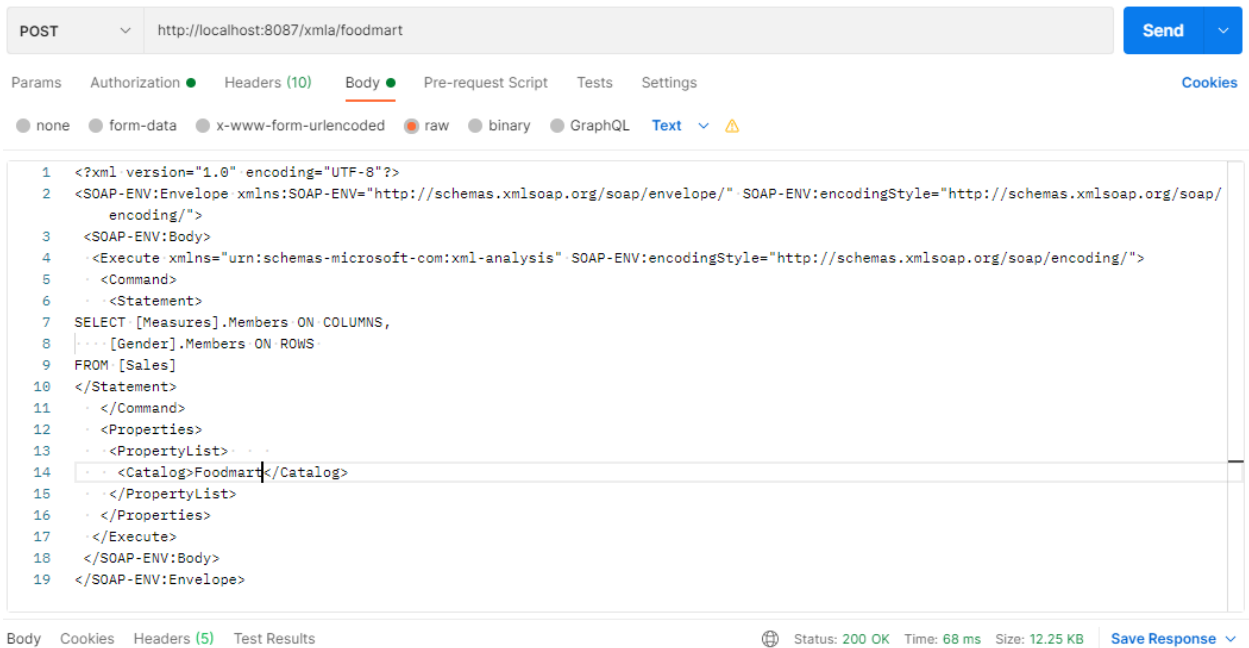
```

● Finally, send request



The screenshot shows the Postman interface for a POST request to `http://localhost:8087/xmla/foodmart`. The 'Headers' tab is active, displaying a list of headers with checkboxes for each. The 'Authorization' header is set to 'Basic YWRtaW46YWRtaW4='.

KEY	VALUE	DESCRIPTION	...	Bulk Edit	Presets
<input checked="" type="checkbox"/> Authorization ⓘ	Basic YWRtaW46YWRtaW4=				➤ Go to authorization
<input checked="" type="checkbox"/> Postman-Token ⓘ	<calculated when request is sent>				
<input checked="" type="checkbox"/> Content-Type ⓘ	application/xml				
<input checked="" type="checkbox"/> Content-Length ⓘ	<calculated when request is sent>				
<input checked="" type="checkbox"/> Host ⓘ	<calculated when request is sent>				
<input checked="" type="checkbox"/> User-Agent ⓘ	PostmanRuntime/7.28.1				
<input checked="" type="checkbox"/> Accept ⓘ	*/*				
<input checked="" type="checkbox"/> Accept-Encoding ⓘ	gzip, deflate, br				
<input checked="" type="checkbox"/> Connection ⓘ	keep-alive				
Key	Value	Description			



```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/
  encoding/">
3 <SOAP-ENV:Body>
4   <Execute xmlns="urn:schemas-microsoft-com:xml-analysis" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
5     <Command>
6       <Statement>
7         SELECT [Measures].Members ON COLUMNS,
8         [Gender].Members ON ROWS
9         FROM [Sales]
10      </Statement>
11    </Command>
12    <Properties>
13      <PropertyList>
14        <Catalog>Foodmart</Catalog>
15      </PropertyList>
16    </Properties>
17  </Execute>
18 </SOAP-ENV:Body>
19 </SOAP-ENV:Envelope>
  
```

Body Cookies Headers (5) Test Results Status: 200 OK Time: 68 ms Size: 12.25 KB Save Response

The Denodo MDX Service supports some of the most common XMLA properties: Catalog, Content and Format. Please note that other XMLA properties might also work, but they should not be considered officially supported in the current version.

The Denodo MDX Service can be used as a data source from XMLA-compatible clients such as Microsoft Excel, Microsoft Power BI and Tableau. Find some examples for this kind of access at the appendices at the end of this document.

## 5 SUPPORTED MDX

The Denodo MDX Service supports many of the main statements, functions and operators of the MDX query language:

NON EMPTY, MEMBERS, CHILDREN, DESCENDANTS, ADDCALCULATEDMEMBERS, WITH\_MEMBER, WITH\_SET, FORMAT\_STRING, SOLVE\_ORDER, FIRSTCHILD, LASTCHILD, CURRENTMEMBER, PARENT, ANCESTOR, EXCEPT, GENERATE, PREVMEMBER, NEXTMEMBER, LEAD, LAG, PARALLELPERIOD, OPENINGPERIOD, CLOSINGPERIOD, PERIODSTODATE, YTD, MTD, QTD, WTD, SUM, CROSSJOIN, ORDER, HEAD, TAIL, TOPCOUNT, TOPPERCENT, COUNT, MAX, MIN, AVG, MEDIAN, STDDEV, <, >, <=, >=, =, <>.

Additionally, there are also some Mondrian-specific functions that you can use in MDX queries, such as IN and NOT IN.

Please note that other MDX functions and structures might also work, but they should not be considered officially supported in the current version.



## 6 OPTIMIZATION USING SUMMARIES

---

Every MDX query produces VQL queries in the VDP datasource of the Denodo MDX Service, some of these queries combine several tables and calculate an aggregation, so it could be a good option use Smart Query Acceleration that it is a technique that includes Denodo 8.

Smart Query Acceleration uses a new type of views called Summaries. These views store common intermediate results that the query optimizer can then use as a starting point to accelerate analytical queries. You can go in depth in the following [link](#). To benefit from summaries, it is important that summaries must be properly chosen. You can use the Diagnostic&Monitor Tool to see the vql queries executed by MDX service Tool and create the appropriate summaries.

The AI & Recommendations Feature Pack for the Denodo Platform includes the Summary Recommendations tool, which makes the creation of summaries much easier. In this [link](#) it is explained how to generate summary recommendations.

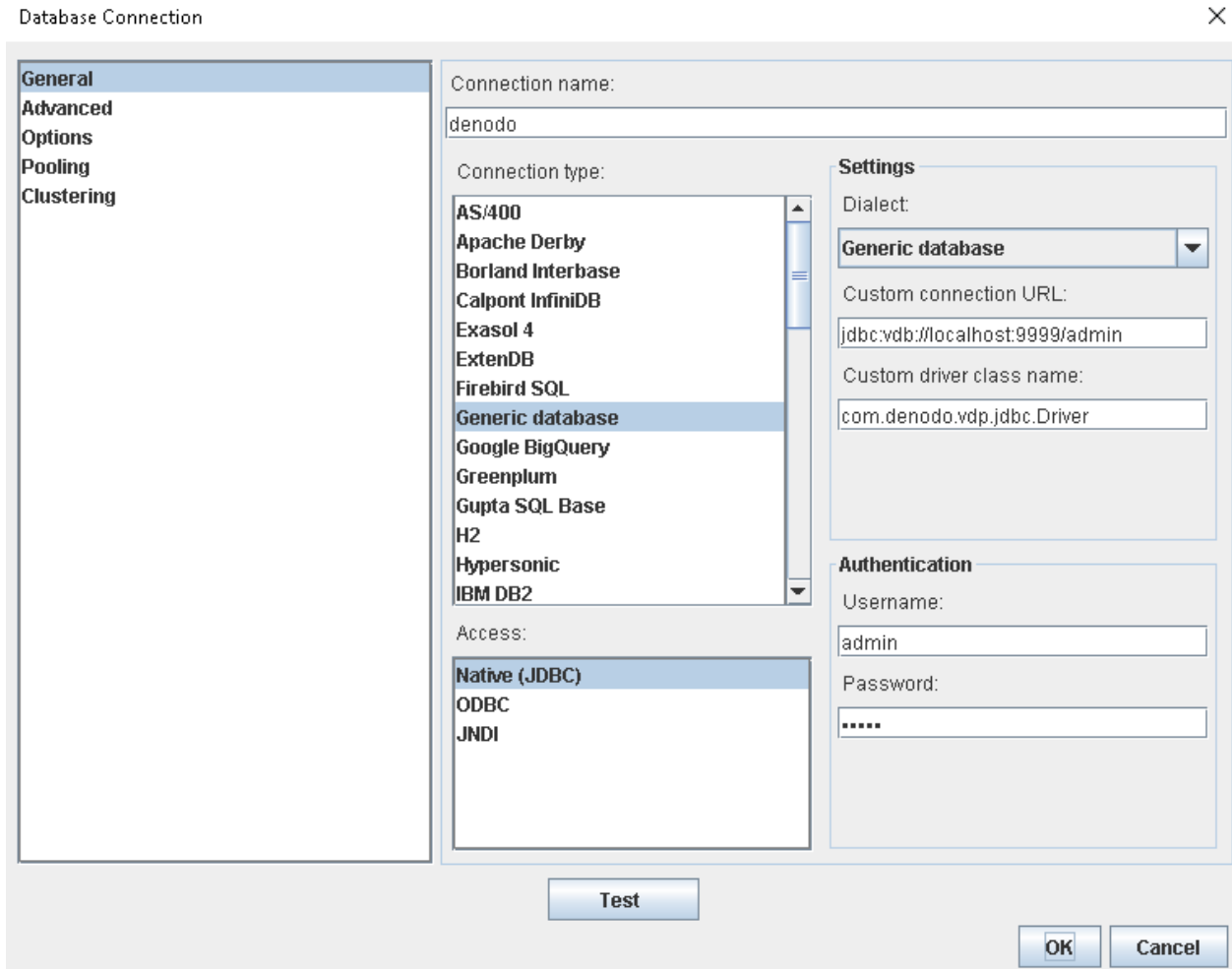
## 7 APPENDICES

---

### 7.1 APPENDIX I. PENTAHO SCHEMA WORKBENCH

In order to create the Schema in Mondrian's XML format, you can use Pentaho Schema Workbench. Follow these instructions:

1. Download the Pentaho Schema workbench (psw-ce-\*\*) from [Hitachi Vantara -pentaho-community-edition](#).
2. Unzip the files.
3. Add the Denodo JDBC driver to the /drivers folder
4. Run the workbench using workbench.bat
5. Once the application opens, connect to Denodo using the Options > Connection action like below



You can then create a Schema with Cubes, Dimensions and Measures. At the Mondrian documentation there is a section about Mondrian Schema Workbench: <https://mondrian.pentaho.com/documentation/workbench.php>

## 7.2 APPENDIX II. CONNECTING FROM MICROSOFT EXCEL

You can connect to the Denodo MDX Service from Microsoft Excel in two ways.

### 1. From Analysis Services

- Go to Data > Get External Data > From Other Sources > From Analysis Services
- Write the url of the XMLA endpoint for the desired Denodo database and configure the authentication.
- Select a Cube

Data Connection Wizard

? X

### Select Database and Table

Select the Database and Table/Cube which contains the data you want.

Select the database that contains the data you want:

Foodmart

Connect to a specific cube or table:

Name	Schema	Description	Modified	Created	Type
HR	FoodMart				PERSPECTIVE
Sales	FoodMart				PERSPECTIVE
Sales 2	FoodMart				PERSPECTIVE
Sales Ragged	FoodMart				PERSPECTIVE
Store	FoodMart				PERSPECTIVE
Warehouse	FoodMart				PERSPECTIVE
Warehouse and Sal...	FoodMart				PERSPECTIVE

Cancel < Back Next > Finish

Data Connection Wizard

? X

### Save Data Connection File and Finish

Enter a name and description for your new Data Connection file, and press Finish to save.

File Name:

http\_\_localhost\_8087\_xmla\_Foodmart Foodmart Sales.odc Browse...

Save password in file

Description:

(To help others understand what your data connection points to)

Friendly Name:

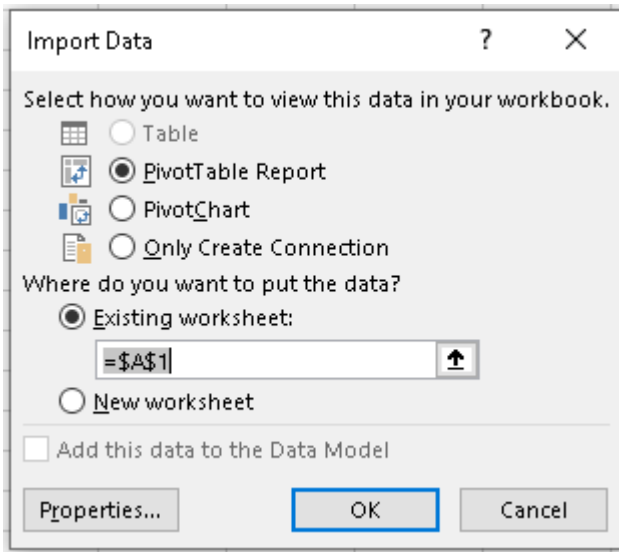
http\_\_localhost\_8087\_xmla\_Foodmart Foodmart Sales

Search Keywords:

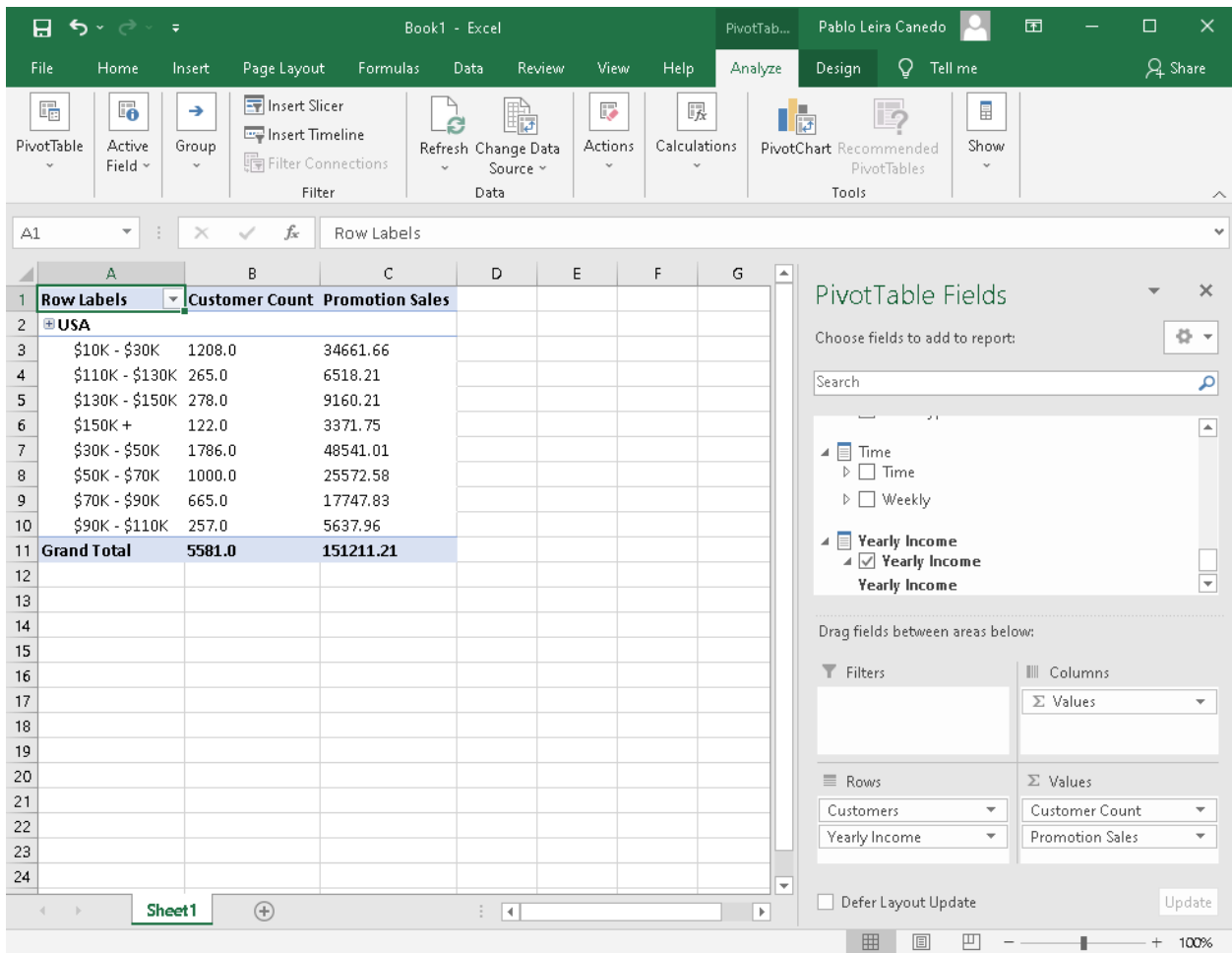
Always attempt to use this file to refresh data

Excel Services: Authentication Settings...

Cancel < Back Next > Finish



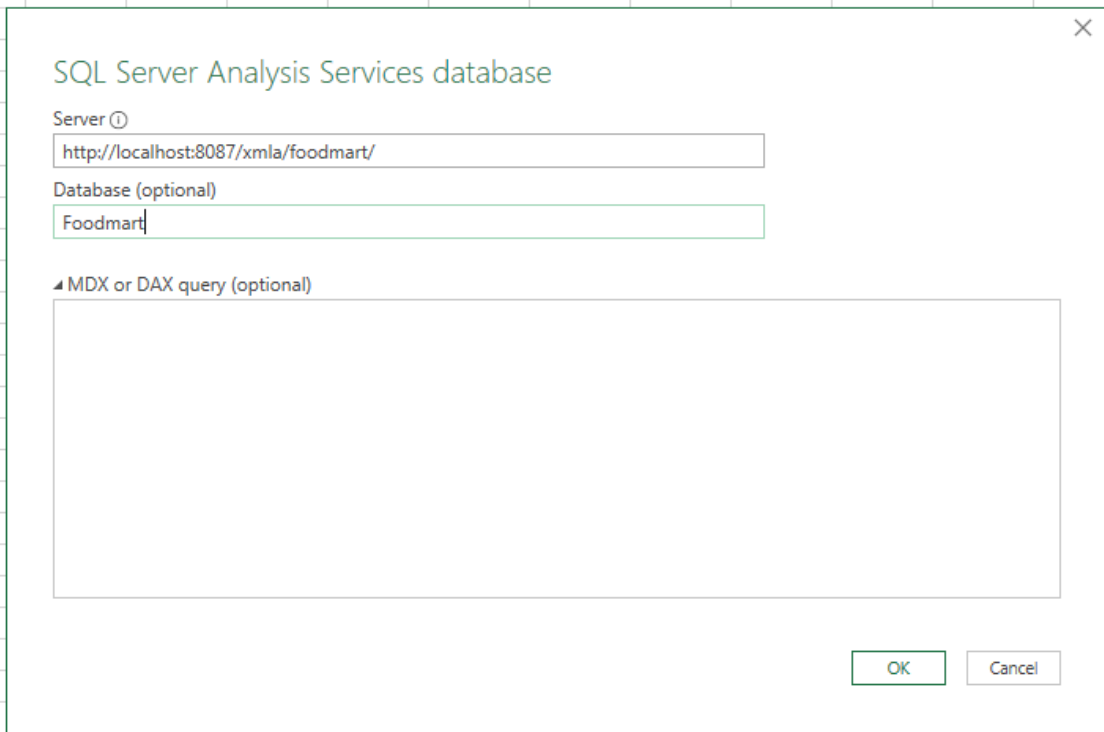
- Select the fields of the cube to get the data.



Row Labels	Customer Count	Promotion Sales
USA		
\$10K - \$30K	1208.0	34661.66
\$110K - \$130K	265.0	6518.21
\$130K - \$150K	278.0	9160.21
\$150K +	122.0	3371.75
\$30K - \$50K	1786.0	48541.01
\$50K - \$70K	1000.0	25572.58
\$70K - \$90K	665.0	17747.83
\$90K - \$110K	257.0	5637.96
<b>Grand Total</b>	<b>5581.0</b>	<b>151211.21</b>

## 2. From SQL Analysis Services Database(import)

- Go to Data > Get External Data > From Other Sources > From SQL Analysis Services Database(Import).
- Write the url of the XMLA endpoint for the desired Denodo database.
- The database has to be one of the catalogs configured in Denodo MDX Service. It is optional, if this field is left empty all catalogs will be displayed.
- The MDX query is optional, if a query is introduced, the result of this query will be loaded in the excel sheet.



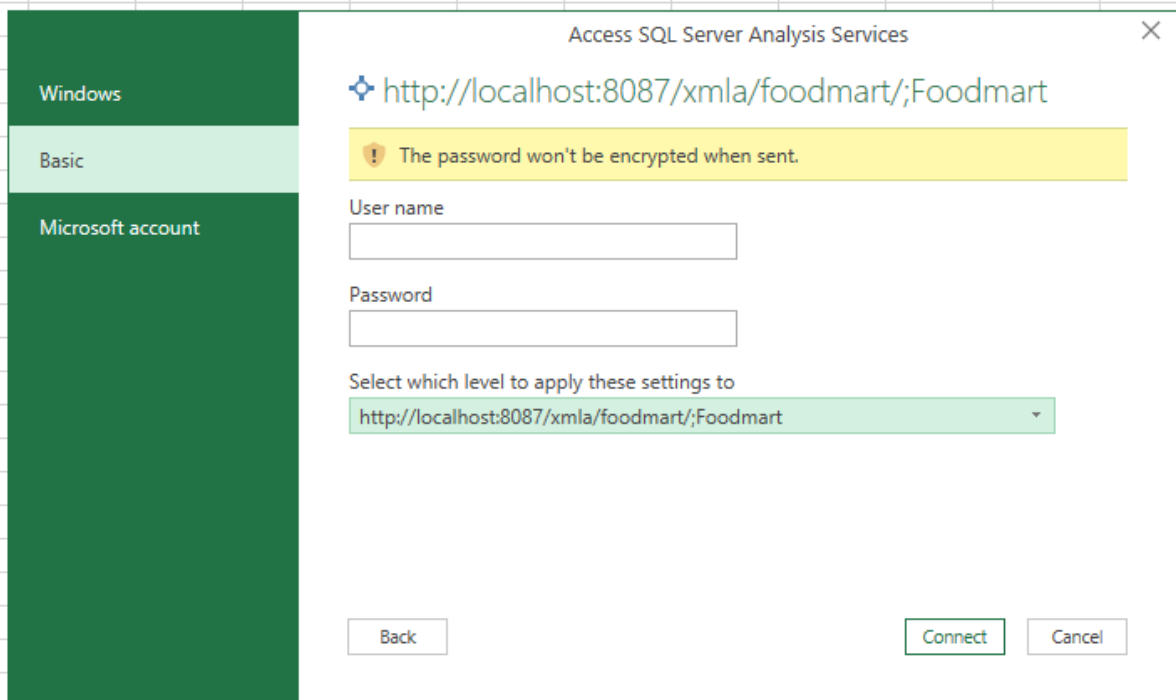
SQL Server Analysis Services database

Server

Database (optional)

MDX or DAX query (optional)

- Configure the authentication.



Access SQL Server Analysis Services

<http://localhost:8087/xmla/foodmart/;Foodmart>

**!** The password won't be encrypted when sent.

User name

Password

Select which level to apply these settings to

- If MDX query field is empty, you have to select the desired dimensions and measures of a single cube.

- Data are loaded in the excel sheet

### **7.3 APPENDIX III. CONNECTING FROM MICROSOFT POWER BI**

You can connect to the Denodo MDX Service from Microsoft Power BI Desktop by following this steps:

- Go to Get Data > SQL Server Analysis Services database.
- Write the url of the XMLA endpoint for the desired Denodo database.
- Select Import access mode
- The database has to be one of the catalogs configured in Denodo MDX Service. It is optional, if this field is left empty all catalogs will be displayed.
- The MDX query is optional, if a query is introduced, the result of this query will be loaded in the excel sheet.

## SQL Server Analysis Services database ×

Server ⓘ

http://localhost:8087/xmla/Foodmart

Database

Foodmart

Import

Connect live

▾ MDX or DAX query (optional)

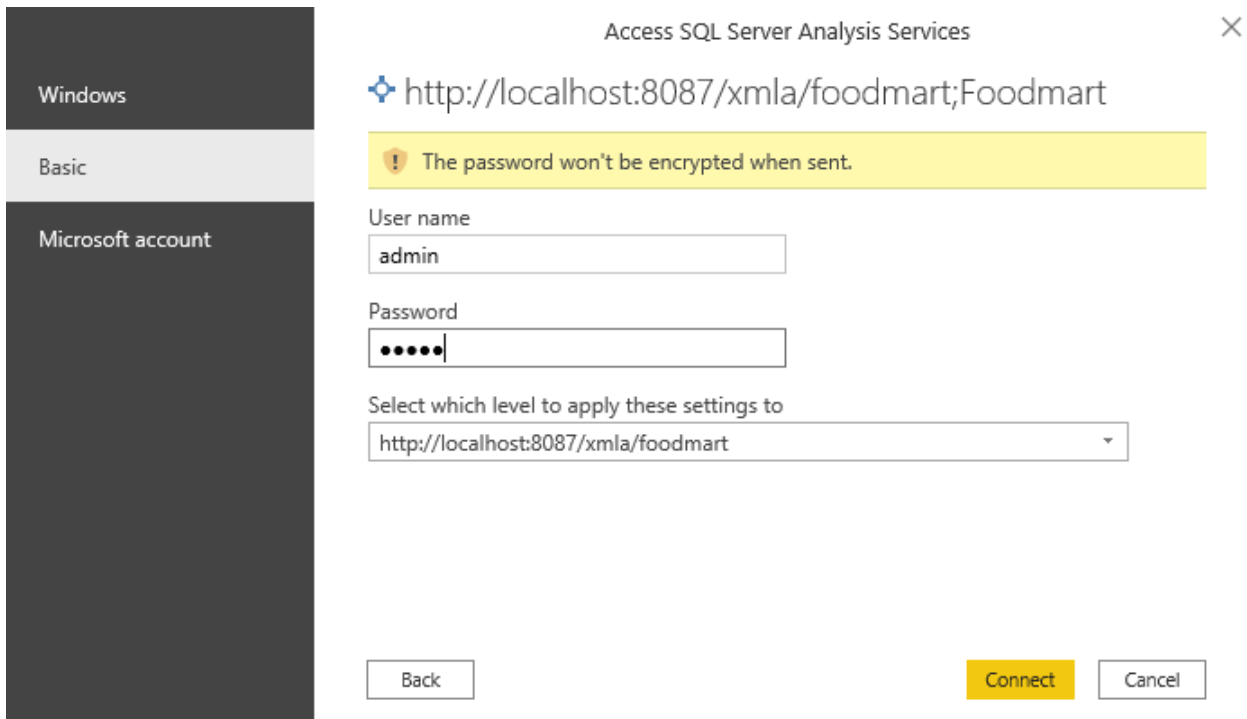
```
SELECT
  [Measures].[Unit Sales] ON COLUMNS,
  { [Product].[Product Family].Members, [Product].[Product Department].Members } ON ROWS
FROM
  ( SELECT [Product].[Drink].[Beverage] ON COLUMNS FROM [Sales] )
```

OK

Cancel

- Select Basic Authentication or Windows Authentication





- A data preview is shown, push the load button and data will be loaded in the report.

http://localhost:8087/xmla/Foodmart: Foodmart

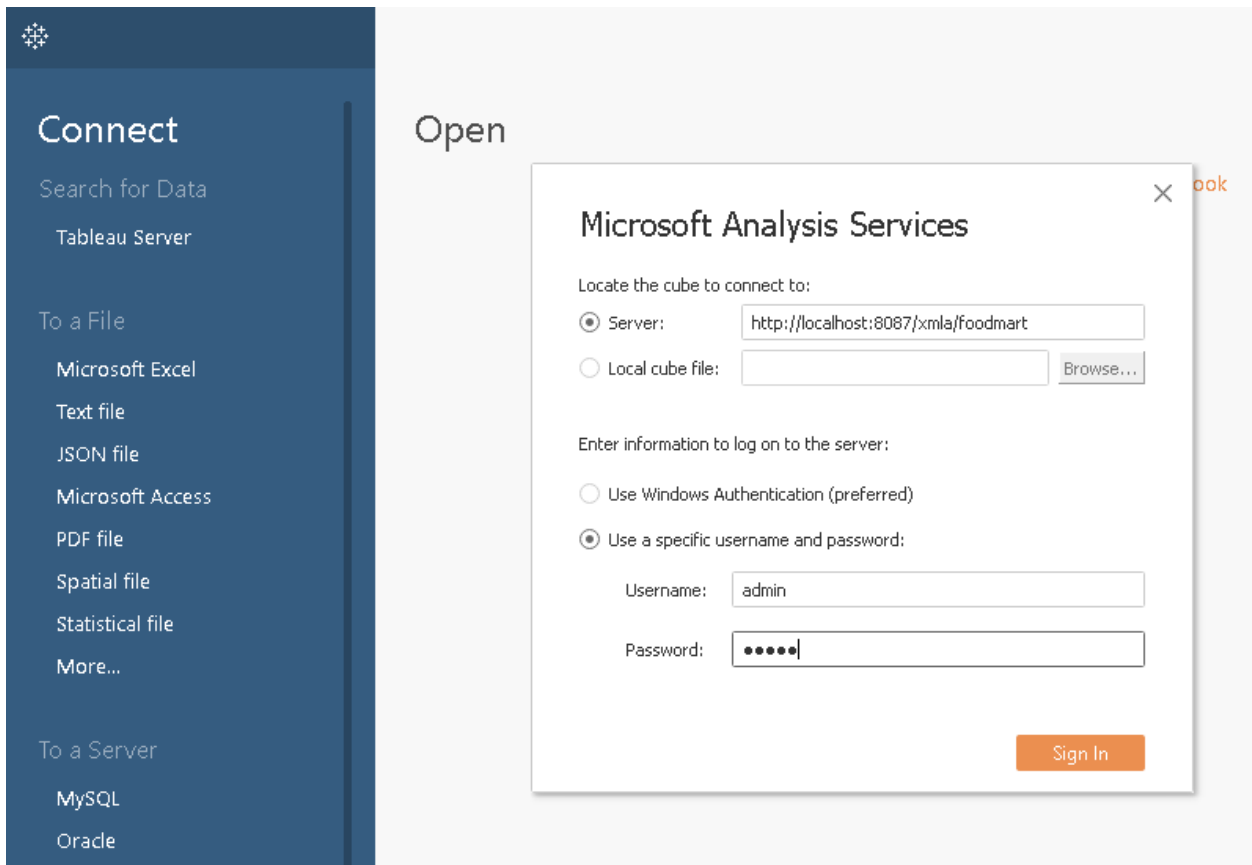
[Product].[Product Family].[MEMBER_CAPTION]	[Product].[Product Department].[MEMBER_CAPTION]	[Measures].[Unit Sales]
Drink	<i>null</i>	24597
Food	<i>null</i>	191940
Non-Consumable	<i>null</i>	50236
Drink	Alcoholic Beverages	6838
Drink	Beverages	13573
Drink	Dairy	4186
Food	Baked Goods	7870
Food	Baking Goods	20245
Food	Breakfast Foods	3317
Food	Canned Foods	19026
Food	Canned Products	1812
Food	Dairy	12885
Food	Deli	12037
Food	Eggs	4132
Food	Frozen Foods	26655
Food	Meat	1714
Food	Produce	37792
Food	Seafood	1764
Food	Snack Foods	30545
Food	Snacks	6884

**i** The data in the preview has been truncated due to size limits.

## 7.4 APPENDIX IV. CONNECTING FROM TABLEAU

You can connect to the Denodo MDX Service from Tableau by following this steps:

- Go to Connect > Microsoft Analysis Services
- Write the url of the XMLA endpoint for the desired Denodo database and configure the authentication.



- Select a database, a cube and a worksheet.

Sales (Foodmart)

Connected to Microsoft Analysis Services <http://localhost:8087/xmla/foodmart>

Step 1: Select a Database: Step 2: Select a Cube:

Enter search text




Name
aSchema1
Foodmart

Enter search text

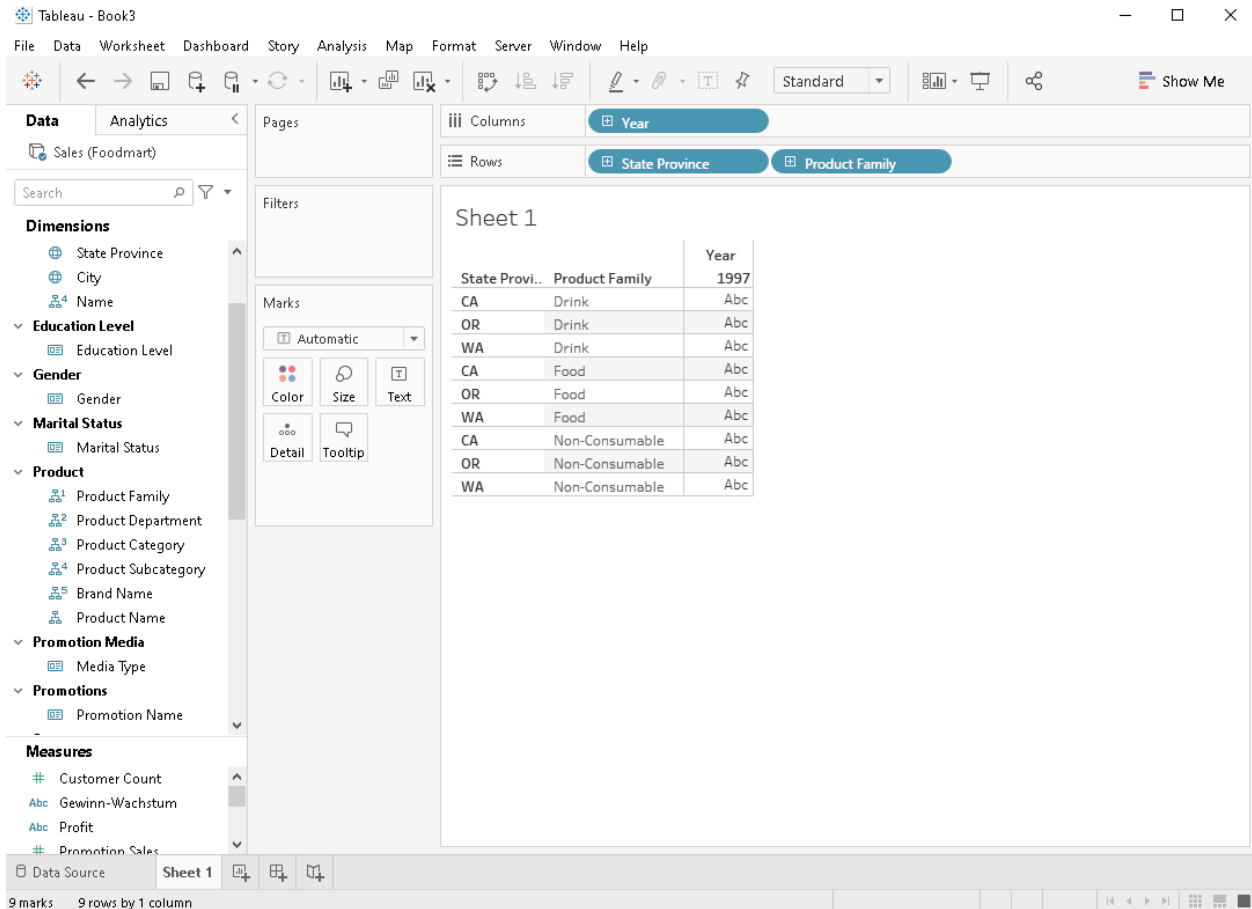
Name
HR
Sales

Sort fields Data source order  Show aliases  Show hidden fields

Field Name	Table	Remote Field Name
# Customer Count	Sales	Customer Count
Abc Profit	Sales	Profit
Abc Gewinn-Wachstum	Sales	Profit Growth
# Promotion Sales	Sales	Promotion Sales
# Sales Count	Sales	Sales Count
# Store Cost	Sales	Store Cost
# Store Sales	Sales	Store Sales
# Unit Sales	Sales	Unit Sales
Birth date		Birth date

Data Source Sheet 1 Sheet 2 




- Select the dimensions and measures



## 7.5 APPENDIX V. CONFIGURE SERVICE TO USE SSL

Follow these steps to secure with SSL the incoming connections:

- Open the /denodo-mdx-service/config/application.properties file
- Add this properties:

```

server.ssl.enabled=true
server.ssl.key-store-type=
server.ssl.key-store=
server.ssl.key-store-password=
server.ssl.key-alias=
    
```

- server.ssl.enabled: Property to enable ssl
  - server.ssl.key-store-type= The format used for the keystore.
  - server.ssl.key-store= The path to the keystore containing the certificate
  - server.ssl.key-store-password=The password used to generate the certificate
  - server.ssl.key-alias=The alias mapped to the certificate
- To apply these changes, stop the MDX Service and start it again.

- After this you will need to import the public key into the clients and also the certificate into the truststore of the clients.

For instance, if you have Denodo installed in the same machine and you already have a certificate configured for your Denodo installation, you can use it easily with a configuration similar to this:

```
server.ssl.enabled=true
server.ssl.key-store-type=JKS
server.ssl.key-store=<DENODO_HOME>/denodo_server_key_store.jks
server.ssl.key-store-password=password
server.ssl.key-alias=denodo-server-self-signed
```

## 8 LIMITATIONS

---

- If you are accessing Denodo MDX Service from Tableau and you have to restart the Denodo MDX service once Tableau has already been connected, your Mondrian session will be lost but Tableau will not notice it and throw an error on next connections. You will have to restart Tableau to fix this.