Presentation Goal and Audience

- What will you learn?
  - Basic concepts of a multidimensional SSAS cube from a querying perspective.
  - Write basic MDX queries to run from SSMS, SSRS, etc.

- Who is this for? Application Developers, BI Developers, QA team.

- Requirements
  - Understanding of basic dimensional modeling concepts
  - An above novice-level of SQL authoring skills
  - Cursory experience with SSAS and MDX
About Me

- 15 years of experience working with Microsoft SQL Server
- Independent consultant working as a BI architect and developer.
- Focus on SSAS and MDX

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Agenda

- Data Warehouse Concepts
- SSAS Multidimensional Data Model
- Measures/Dimensions
- MDX
- Capturing MDX Queries
Multi Dimensional EXpressions (MDX)

- SQL Server 2012: SSAS Multi-Dimensional (MD) and Tabular.
- MDX: Language of SSAS in MD.
- MDX queries.
- MDX script.
Data Warehouse Concepts

- Fact tables
- Dimension tables
- Star Schema
- Joins
SQL Server

Server

Database

Tables
SSAS Data Model

A multi-dimensional data structure: Detail Data and Aggregations. Relationships between tables/objects already defined.
SSAS Data Model

- Date
- Customer
- Product

[Sales Amount]

Slices

- Sum of Sales Amount
- 2005 Sales Amount
- 2006 Sales Amount
- 2007 Sales Amount
- 2008 Sales Amount

All Products & Customers
SSAS Server

AdevntureWorksDW2012Multidimensional

Server

Database

Cube

- Measure Groups
- Dimensions
Measures

- Numerical Values
- Predefined aggregations
- Sum, Min, Max, Avg, …
- Measures return aggregated results unless broken down by dimensions.

[Measures].[Internet Sales Amount]
Dimensions

- DimDate
- [Date].[Calendar Quarter]
Hierarchies

- Navigational Paths or Data Rollups
- Day $\rightarrow$ Month $\rightarrow$ Quarter $\rightarrow$ Year
User Defined Hierarchies

Attributes → Levels. All level: All Periods.

[Dimension].[Hierarchy].[Level].[Member]

[Date].[Calendar].[Calendar Quarter].[CY Q1]
Each attribute has a built in hierarchy with the same name. Two levels: All Level → Attribute Level

**[Dimension].[Hierarchy].[Level].[Member]**

[Date].[Calendar Quarter of Year].[Calendar Quarter of Year].[CY Q1]

[Date].[Calendar Quarter of Year].Members

[Date].[Calendar Quarter of Year].[Calendar Quarter of Year].Members
### Axis

- **Columns**: 0
- **Rows**: 1
- **Pages**: 2
- **Chapters**: 3
- **Sections**: 4
Parts of Query and Execution Stages

- With Set/Cal Member…
- SELECT
- … ON COLUMNS
- … ON ROWS
- FROM
- WHERE
Columns Only Query

```sql
SELECT SUM([SalesAmount]) AS SalesAmount
FROM [dbo].[FactInternetSales]
```

```sql
SELECT {[Measures].[Internet Sales Amount]}
ON COLUMNS
FROM [Adventure Works]
```

<table>
<thead>
<tr>
<th>SQL</th>
<th>MDX</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELECT, FROM</td>
<td>SELECT, FROM</td>
</tr>
<tr>
<td>SUM()</td>
<td>Aggregation predefined.</td>
</tr>
<tr>
<td>From table.</td>
<td>From Cube.</td>
</tr>
</tbody>
</table>
Rows and Columns

```sql
SELECT dc.EnglishOccupation, SUM([SalesAmount]) AS SalesAmount
FROM [dbo].[FactInternetSales] fIS
JOIN DimCustomer dc
ON fIS.CustomerKey = dc.CustomerKey
GROUP BY dc.EnglishOccupation
```

```sql
SELECT {[Measures].[Internet Sales Amount]} ON COLUMNS,
[Customer].[Occupation].[Occupation].MEMBERS ON ROWS
FROM [Adventure Works]
```
More Basic Functions/Concepts

- {...,...,...}
- NON EMPTY
- WHERE
- MEMBERS
- TUPLE
- CALCULATED MEMBERS, CURRENTMEMBER
- CROSSJOIN
Demo …

MDX

SQL
Functions to Learn Next

- NONEMPTY (not the same as NON EMPTY)
- FILTER
- ORDER
- CHILDREN
- DESCENDANTS
Looking at MDX Queries

- Excel
  - Free Pivot Table Extensions add in from CodePlex:
  - [https://olappivottableextend.codeplex.com/](https://olappivottableextend.codeplex.com/)
  - MDX tab --> Format with Web Service.

- SQL Server Profiler
  - Trace
  - Event: Query End.
Demo ...

MDX
Pivot Table Extensions

```sql
SELECT
{ [Measures].[Internet Sales Amount], [Measures].[Internet Order Count] }
DIMENSION PROPERTIES PARENT_UNIQUE_NAME,
    HIERARCHY_UNIQUE_NAME ON COLUMNS,
    NON EMPTY Hierarchize(
    {
        DrilldownLevel(
        {
            [Customer].[Occupation].[All Customers] 
        },
        ,
        INCLUDE_CALC_MEMBERS
        )
    })
) DIMENSION PROPERTIES PARENT_UNIQUE_NAME,
    HIERARCHY_UNIQUE_NAME ON ROWS
FROM [Adventure Works] CELL PROPERTIES VALUE,
    FORMAT_STRING,
    LANGUAGE,
    BACK_COLOR,
    FORE_COLOR,
    FONT_FLAGS
```
Profiler
Review

- Numeric Columns → Measures in Measure Groups
- Descriptive Columns → Attributes /Hierarchies in Dimensions
- Grid:
  - Axis: Rows and Columns
  - Cells: Middle
  - SELECT .. ON .. FROM … WHERE …
Resources

- Books
  - Microsoft SQL Server 2008 Analysis Services Unleashed

- Online
  - MDX Language Reference