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**MDX**

**DOCUMENTATION**

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# I. Introduction to MDX

## 1. What is MDX?

- MDX stands for Multidimensional Expressions.
- It is a query language used primarily for querying and manipulating data in multidimensional databases, particularly in OLAP (Online Analytical Processing) systems.
- MDX is designed to work with data organized into dimensions and hierarchies, making it well-suited for analytical and business intelligence tasks.

## 2. Why is MDX important?:

- MDX is crucial in the realm of business intelligence and data analysis as it allows users to extract valuable insights from multidimensional data sets.
- It enables users to create sophisticated queries for aggregating, filtering, and analyzing data from multidimensional databases.
- MDX plays a significant role in decision support systems and reporting tools, helping organizations make informed decisions based on their data.

## 3. Where is MDX used?

- MDX is primarily used in OLAP databases, including products like Microsoft SQL Server Analysis Services (SSAS), Oracle OLAP, and IBM Cognos TM1.

## II. Fundamental Concepts

### 1. Dimensions and Hierarchies

#### a. Defining Dimensions

- Dimensions represent categories or aspects of data, such as time, geography, products, or customers.
- They are defined to organize and categorize data, allowing for meaningful analysis.
- Examples of dimensions might include "Time," "Geography," or "Product Category."

#### b. Creating Hierarchies

- Hierarchies are logical structures within dimensions that define the relationships between different levels of granularity within a dimension.
- Hierarchies enable drill-down and roll-up operations, allowing users to navigate data from more general to more specific levels.
- For example, a "Time" dimension hierarchy could include levels like "Year," "Quarter," "Month," and "Day."

## 2. Measures

### a. Understanding Measures

- Measures are numeric values that represent the data to be analyzed, such as sales revenue, quantity sold, or profit margin.
- They are typically stored in fact tables and provide the quantitative aspect of the data.
- Measures can be aggregated and analyzed across dimensions to gain insights into the data.

### b. Aggregations and Calculations

- Aggregations involve summarizing measures at various levels of dimensions. Common aggregation functions include SUM, AVG, COUNT, MIN, and MAX.
- Calculations involve creating new measures or modifying existing ones using MDX expressions. Examples include calculated growth rates, profitability ratios, or custom aggregations.
- MDX provides a rich set of functions for performing calculations, including arithmetic, logical, and statistical functions.

## III. Fundamental Concepts

### 1. Basic MDX Query Structure

#### a. SELECT statement

```
SELECT  
    [Measures].[Sales Amount] ON COLUMNS,  
    [Time].[Year].Members ON ROWS  
FROM [Sales]
```

#### b. WHERE clause

```
SELECT  
    [Measures].[Profit] ON COLUMNS  
FROM [Sales]  
WHERE [Time].[Year].[2022]
```

#### c. Axis specification (ROWS, COLUMNS)

```
SELECT  
    [Measures].[Sales Amount] ON COLUMNS,  
    [Time].[Month].Members ON ROWS  
FROM [Sales]
```

## 2. Retrieving Data

### a. CrossJoin and NonEmpty functions

```
SELECT
    [Measures].[Sales Amount] ON COLUMNS,
    CrossJoin([Time].[Year].Members, [Product].[Category].Members) ON ROWS
FROM [Sales]
WHERE NonEmpty([Measures].[Sales Amount])
```

### b. Filter conditions

```
SELECT
    [Measures].[Profit] ON COLUMNS,
    [Product].[Subcategory].Members ON ROWS
FROM [Sales]
WHERE (
    [Measures].[Sales Amount],
    [Time].[Year].[2022]
) > 1000
```



### 3. Sorting and Filtering

#### a. ORDER BY clause

```
SELECT
  [Measures].[Sales Amount] ON COLUMNS,
  [Product].[Category].Members ON ROWS
FROM [Sales]
ORDER BY [Measures].[Sales Amount] DESC
```

### 4. Slicing and Dicing

#### a. USING keyword

```
SELECT
  [Measures].[Profit] ON COLUMNS,
  [Time].[Quarter].Members ON ROWS
FROM [Sales]
USING [Time].[Year].[2022]
```

#### b. Hierarchical navigation

```
SELECT
  [Measures].[Sales Amount] ON COLUMNS,
  [Time].[Year].[2022].[Q1] ON ROWS
FROM [Sales]
```

# III. Conclusion

## 1. Recap of MDX Key Concepts

MDX (Multidimensional Expressions) is a query language used for multidimensional databases, particularly in OLAP systems.

### a. Key Concepts:

- **Dimensions and Hierarchies:** Dimensions categorize data, and hierarchies define relationships within dimensions.
- **Measures:** Measures are numeric values representing data for analysis.
- **MDX Queries:** Queries consist of SELECT, FROM, WHERE, and AXIS clauses.
- **Sorting and Filtering:** ORDER BY sorts data, and WHERE filters data.
- **Slicing and Dicing:** USING specifies dimensions for analysis, and hierarchical navigation drills into data.
- **Sets and Tuples:** Set functions manipulate sets, and tuple functions work with combinations of members.

It's important to adapt to evolving technologies and tools in the world of data analytics and business intelligence while recognizing that MDX will continue to have relevance in certain contexts. Understanding MDX can still be valuable, especially for maintaining and optimizing existing OLAP solutions.

