

Paper CS-055

The Various Mechanisms of Calculated OLAP Cube Measures

Angela Hall, Zencos Consulting, Cary, NC

ABSTRACT

OLAP Cubes are extremely useful in storing and pre-summarizing large data volumes for quick queries. SAS® OLAP Cubes can be created in Proc OLAP steps or via SAS OLAP Cube Studio while cube measures can be defined within these. Find out how these same measures are defined and managed as well as some of the advantages and disadvantages we have come across.

DEFINITIONS

OLAP – OnLine Analytical Processing

MDX – Multi-Dimension Expressions

Metadata – Data about the data, such as label, format, etc.

Sets – A defined group of members, typically a subset of the data that is utilized frequently for querying or measuring by.

DEFINING CUBE MEASURES IN PROC OLAP

Within Proc OLAP, the MEASURE statement is used to define the measurement name, statistics, source column, and associated metadata.

```
measure Sales_Sum
  stat=sum
  aggr_column="SumOfSales"
  analysis="Sales"
  desc='Sum of Sales'
  units='Dollars'
  format=dollar10.2
;
```

Required Elements Include Measure, Stat, and Column or Aggr_Column.

1. Measure Names can be 32 characters in length and spaces, mixed letters and special characters can be utilized just surround with single quotes and add an n, for example 'Product@RatioB'n.
2. Stat options are minimal.
3. Column or Aggr_Column provide the variable name that is the source for the statistic.

DEFINING CUBE MEASURES IN SAS® OLAP CUBE STUDIO

OLAP Cube Studio offers users an interface to create the same measure that is available to define within the PROC OLAP Code.

As the user completes the OLAP Cube Studio Cube Designer, the Select Measures screen is offered.

Cube Designer - Select Measures

Select the column and statistics you want to define as measures for this cube. Use the right arrow to move the columns and statistics you selected into the Selected Measures tree. Expand a column to see a list of available statistics. Optionally, select Define Distinct Count to add or remove Distinct Count (NUNIQUE) measures.

Available

- Degree
 - Count
 - Count of missing values
 - Uncorrected sum of squares
 - Corrected sum of squares
 - Variance
 - Standard deviation
 - Standard error of mean
 - Coefficient of variance
 - T Value
 - Probability of greater absolute value
 - Lower confidence limit
 - Upper confidence limit

Selected

- Selected
 - Degree
 - Closeness
 - Betweenness

Defined Distinct Count level/hierarchy combinations:

Define Distinct Count

Help Cancel < Back Next > Finish

After selecting the measures, the user then is able to modify the metadata.

Cube Designer - Measure Details

Review the measure information and modify attributes, such as Caption or Format, for each measure. You can also change the default measure for the cube.

Default Measure: BetweennessAVG

Edit details for each measure

Measure Name	Input Column	Statistic	Caption
BetweennessMAX	Betweenness	MAX	Maximum Betweenness
BetweennessMIN	Betweenness	MIN	Minimum Betweenness
BetweennessRANGE	Betweenness	RANGE	Betweenness Range
ClosenessSUM	Closeness	SUM	Sum of Closeness
ClosenessAVG	Closeness	AVG	Average Closeness
ClosenessMAX	Closeness	MAX	Maximum Closeness
ClosenessMIN	Closeness	MIN	Minimum Closeness
ClosenessRANGE	Closeness	RANGE	Closeness Range
DegreeRANGE	Degree	RANGE	Degree Range
DegreeMAX	Degree	MAX	Maximum Degree
DegreeMIN	Degree	MIN	Minimum Degree
DegreeAVG	Degree	AVG	Average Degree
DegreeSUM	Degree	SUM	Sum of Degree

Help Cancel < Back Next > Finish

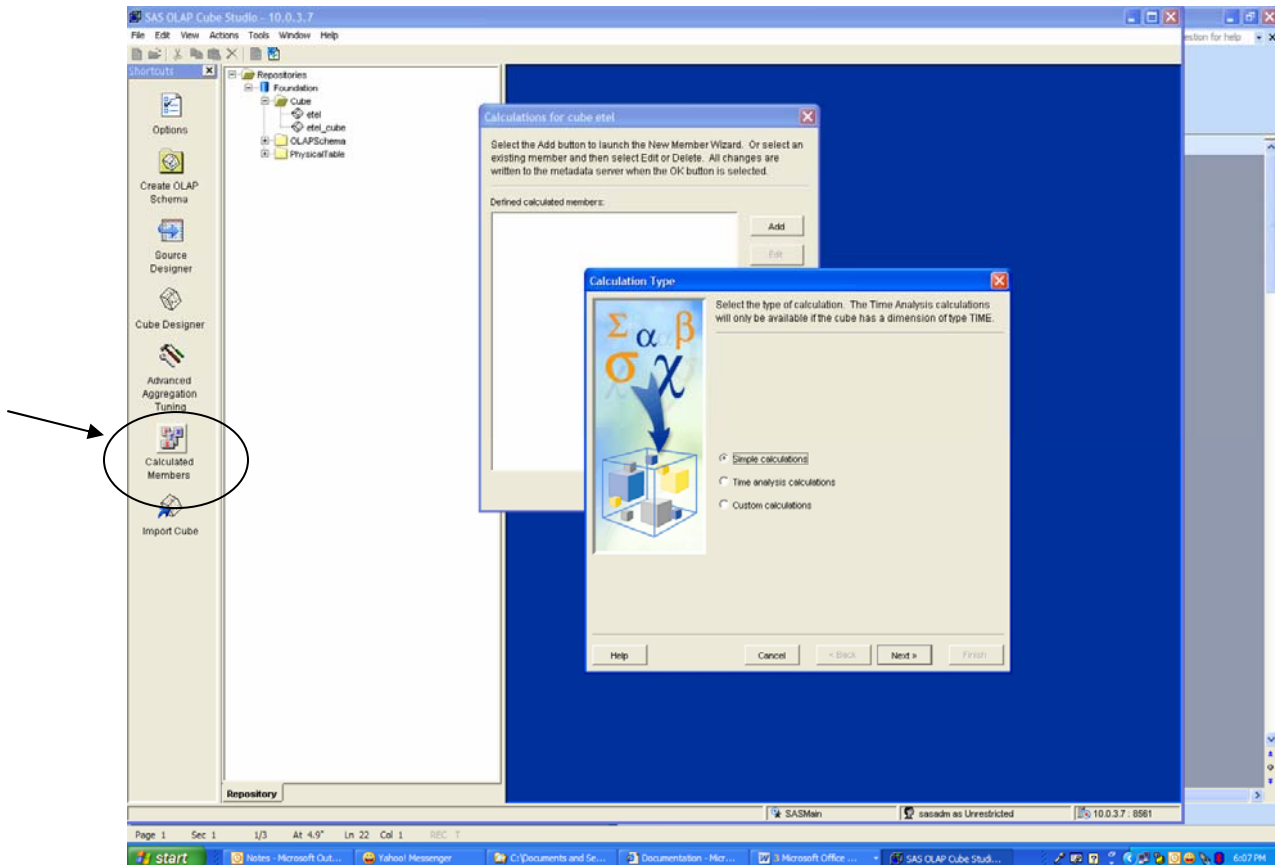
From OLAP Cube Studio Help, the following are definitions of these Metadata Attributes.

Attribute	Description
Measure Name	Displays the names of all the measures defined for the cube. The measure name is a valid SAS name (up to 32 characters) that you can modify.
Input Column	Displays the names of the columns in the input data source that contain the values that will be used to calculate the statistic shown in the corresponding Statistic column. This field is read-only.
Statistic	Displays the names of the statistics that you selected on the Select Measures window of the Cube Designer wizard. For a list of available statistics, see Statistics Available for Measures. This field is read-only.
Caption	Displays a caption for each measure. You can enter up to 256 characters. Third-party applications that report on cube data can be designed to display this measure caption.
Format	Displays a format for each measure. The default format depends on whether or not the cube is loaded from a fully summarized data source. For cubes that are not loaded from a fully summarized data source, the statistics SUM, MIN, MAX, RANGE, AVG, STD, STDERR, LCLM, and UCLM use the format assigned to the input column.
Format Used	For cubes that are loaded from a fully summarized data source, the default format is BEST12. To change the default, click in the Format field to enable a drop-down list of SAS formats, then select the format that you want to assign to the measure. After you have selected a format, you can choose to change the default width and decimal places by clicking in the field. For example, you might select DOLLAR and then type 8.2 to specify the width (8) and the number of spaces to the right of the decimal point (2). Your selected SAS format will be used to display the value of the corresponding measure.
Units	Displays a unit description for each measure. You can enter up to 256 characters that are used to display a description of the measure's units (for example, Pounds Sterling).
Description	Displays a description for each measure. You can enter any number of characters to create an optional description that is associated with the measure. The default description is the measure name. Third-party applications that report on cube data can be designed to display this measure description.

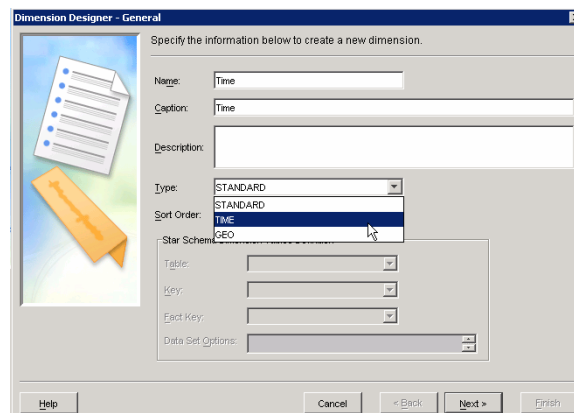
DEFINING MEASURES IN SAS OLAP CUBE STUDIO – CALCULATED MEMBERS

Within the Calculated Members option of SAS OLAP Cube Studio (SP4), users can create custom measures for use by cube users. This same plug in is available from DI Studio.

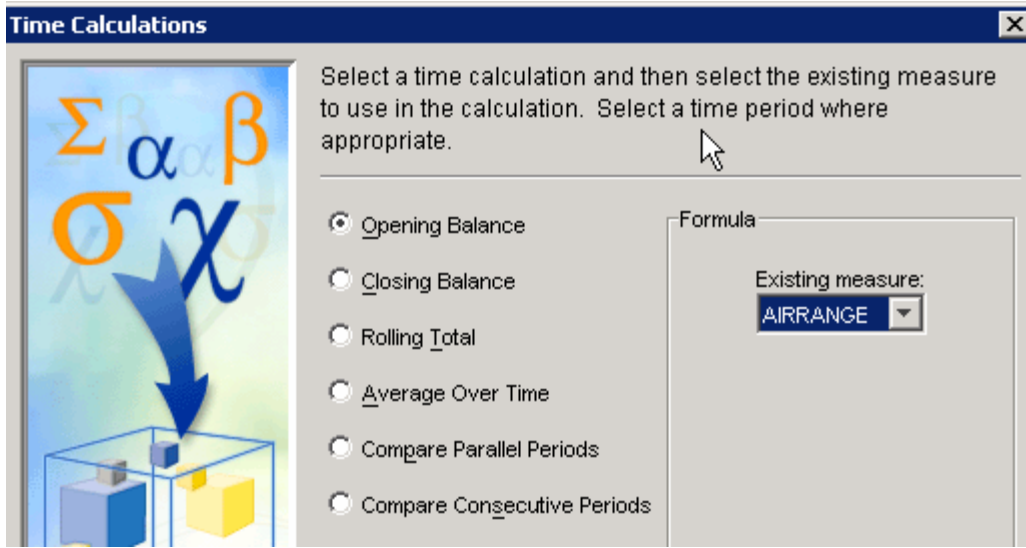
Simple Calculations, Time Analysis Calculations and Custom Calculations are available options. Within this user interface, advanced measures such as ratios, time period comparisons and those requiring MDX functions can be defined for use during OLAP viewing through SAS Enterprise Guide or SAS Web OLAP Viewer. Changes in this area of OLAP Cube Studio will not necessitate regeneration of the OLAP code, the new measures are immediately available within the client tools.



Note: To utilize the calculation type 'Time analysis calculation', a valid Time Dimension is required. This is defined during cube creation. Included is a screenshot of this option from OLAP Cube Studio.



After 'Time analysis calculation' is selected, available time calculations are shown on the following Calculate Member Interface:



Time Calculations

Select a time calculation and then select the existing measure to use in the calculation. Select a time period where appropriate.

☒ Opening Balance
☐ Closing Balance
☐ Rolling Total
☐ Average Over Time
☐ Compare Parallel Periods
☐ Compare Consecutive Periods

Formula

Existing measure:
AIRRANGE

Opening Balance – Provides the measure total for the first time period selected in a set.

Closing Balance – Provides the measure total for the last time period selected in a set

Rolling Total – Sums the measure over each time period.

Average Over Time – Averages the measure over each time period.

Compare Parallel Periods – Gives the difference of the measure over the same time period in the previous

Compare Consecutive Periods – Gives the difference between the current time period and the previous time period.

DEFINING MEASURES IN MDX

During PROC SQL queries on OLAP cubes, custom measures can be defined and utilized immediately.

Included is a sample query below.

```
/*Start the SQL statement, connect to the OLAP system*/
```

```
proc sql;
```

```
connect to olap (host="sasservername" port=8561 user="sasuser" pass="saspassword");
```

```
/*Create a table*/
```

```
CREATE TABLE work.sample as select * from connection to olap (
```

```
WITH
```

```
/*Create a custom measure & also the location to define sets*/
```

```
MEMBER Measures.Ratio AS
```

```
CoalesceEmpty(
```

```
[Measures].[Cancels]
```

```
/
```

```
([Date].[ Date].CurrentMember, &GroupVar, [Measures].[TotalCount] ),0)
```

```
SELECT
```

```
/*All measures are selected*/
```

```
{ [Measures].AllMembers } ON COLUMNS ,
```

```
/*Establish Row Selected*/
```

```
{
```

```
CrossJoin ( {[Date].[All Date].[&year].[&mo] } ,
```

```
{ &GroupVar }
```

```
)
```

```
} ON ROWS
```

```
/*Define Cube to Select From*/
```

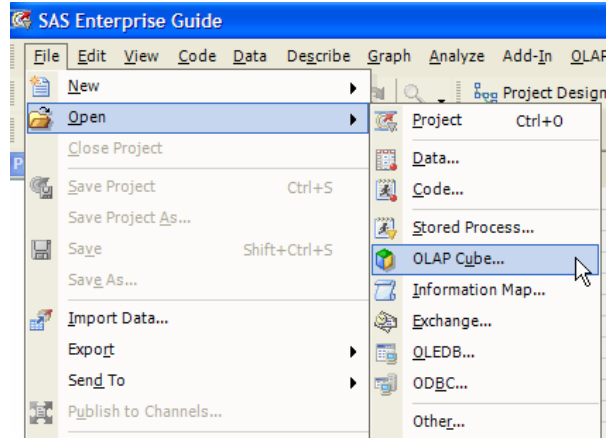
```
FROM [cube]
```

```
);
```

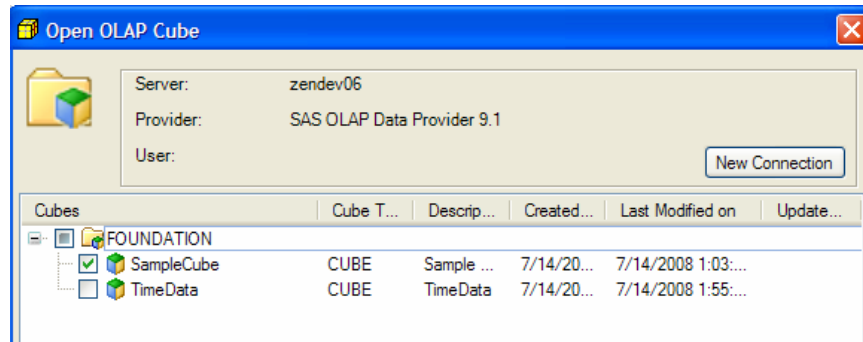
DEFINING MEASURES VIA SAS ENTERPRISE GUIDE

Analytic users can open OLAP cubes in SAS Enterprise Guide and derive additional measures. Included are the screenshots to connect to open a cube and create a new measure.

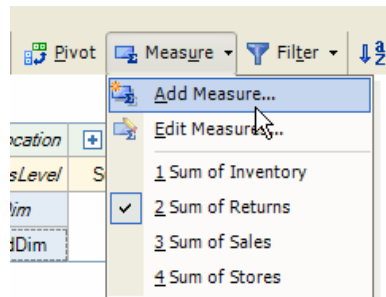
1. File ->Open->OLAP Cube:



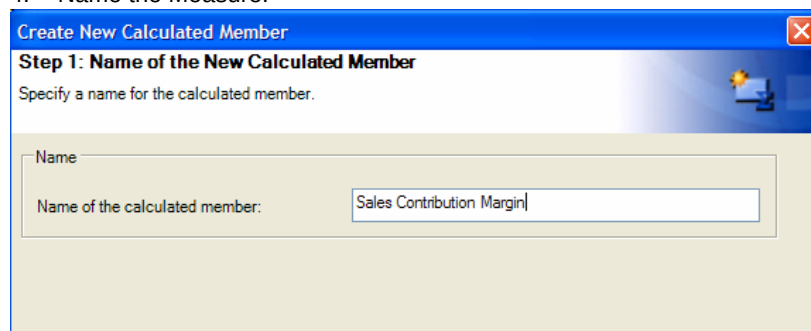
2. Select the OLAP Cube to view:



3. Add the Measure:



4. Name the Measure:



5. Select the Type of Analysis:

Create New Calculated Member

Step 2: Select the Type of Analysis

Select the type of analysis that you want to perform with the new calculated member.

Type of analysis:

- ☐ Simple calculations
- ☐ Time Series analysis
- ☐ Trends and Forecasting analysis
- ☒ Count analysis
- ☒ Relative Contribution analysis
- ☐ Custom calculation

6. Specify type of measure:

Create New Calculated Member

Step 3: Select a Relative Contribution Analysis

Select the type of calculation for the new calculated member.

Type of relative contribution analysis:

- ☒ Member contribution relative to a total value
- ☐ Member contribution relative to its parent

☐ Show result as percentage

7. Select the measure this relates to:

Create New Calculated Member

Step 4: Specify an Existing Measure

Specify the existing measure that you want to use in the calculation.

Existing Measure

Sum of Sales

8. Select the dimension (and hierarchy that this measure is based on:

Create New Calculated Member

Step 5: Select a Member

Select the members that you want to evaluate.

Dimension Members

Dimensions: Location

Members: ProdDim

Africa

9. Specify other parameters:

Create New Calculated Member

Step 6: Specify Other Parameters

Specify the parent, dimension, level, format, and solve order for the new calculated member.

Parent dimension: MEASURES

Insert at level: Measures

Use format: Percent %

Solve order: 0

10. Mark whether this is available again:

Create New Calculated Member

Step 7: Select the Scope

Specify how long you would like to keep the new calculated member.

Type of scope:

☐ Temporary

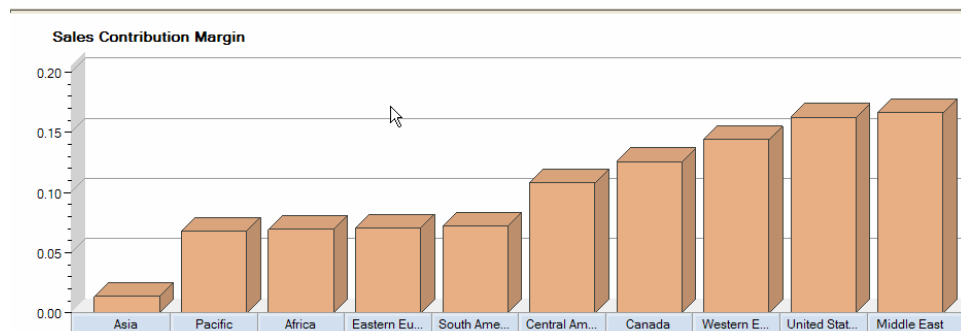
☒ Available during this session only

☐ Global, always available

☒ Add to current query

11. Results:

All ProdDim		All ProdDim
Region	MeasuresLevel	
Asia	Sales Contribution Margin	1.36%
Pacific	Sales Contribution Margin	6.78%
Africa	Sales Contribution Margin	6.92%
Eastern Europe	Sales Contribution Margin	7.07%
South America	Sales Contribution Margin	7.19%
Central America/Caribbean	Sales Contribution Margin	10.81%
Canada	Sales Contribution Margin	12.57%
Western Europe	Sales Contribution Margin	14.40%
United States	Sales Contribution Margin	16.26%
Middle East	Sales Contribution Margin	16.64%



UTILIZING SETS

Sets are used to define a subgroup of the cube data. These can be defined within the MDX query or via SAS Information Map Studio.

The first set sample is defining a date range subquery from April to July 2006.

Set [daterange] as { [DateValue].[All DateValue].[2006].[04] : [DateValue].[All DateValue].[2006].[07]}

To utilize this set, you would then declare a member such as:
Member [DateValue].[Filter] as 'sum([daterange])'

The second sample is defining a specific state to query on:

Set [NOnly] AS { [States].[All States].[North Carolina]}

Again to utilize this set, you would then declare a member such as:
Member [States].[sub] as 'Aggregate([NOnly])'

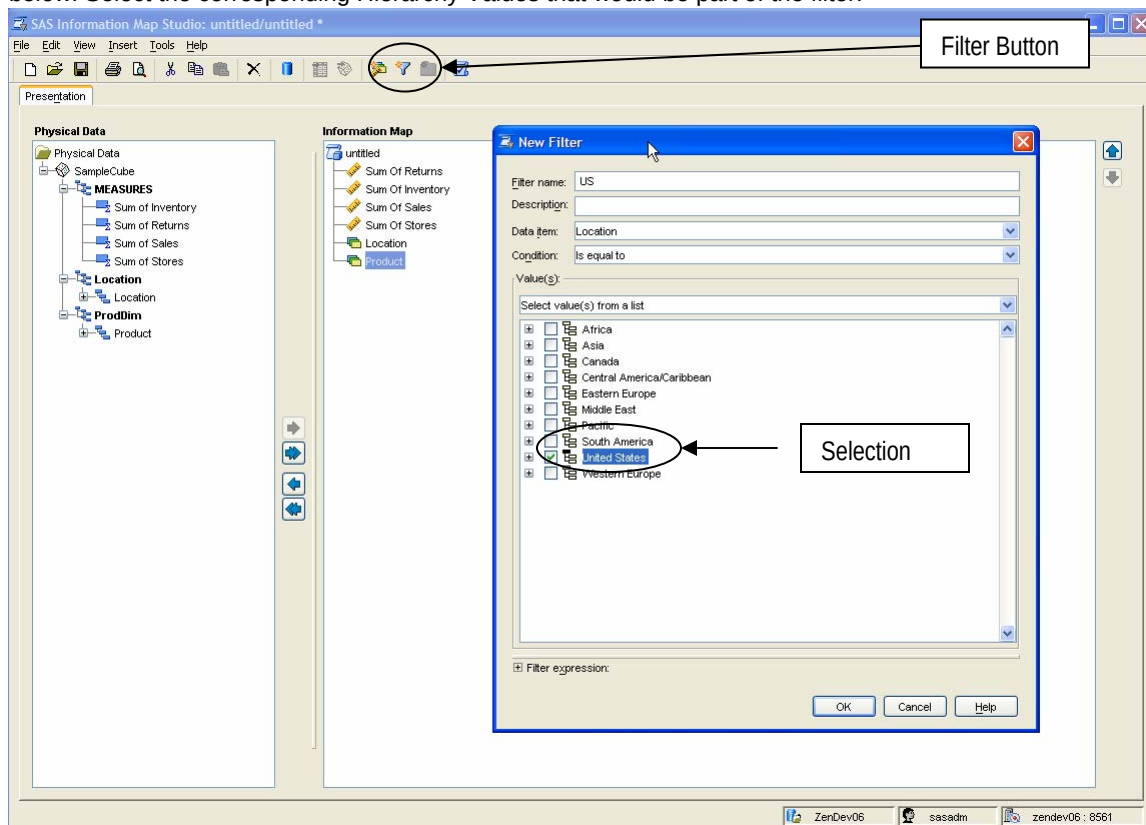
To include multiple states within a set, a comma needs to be used between the members:

Set [EasternSeaboard] AS { [States].[All States].[Maine], [States].[All States].[New York], [States].[All States].[Pennsylvania], [States].[All States].[Maryland], [States].[All States].[New Jersey], [States].[All States].[North Carolina], <etc> }

Utilize this set by declaring a member such as:
Member [States].[sub] as 'Aggregate([EasternSeaboard])'

Defining Sets in Information Map Studio is as simple as defining a Filter.

After inserting the Cube into a new map and selecting data items, click the Filter Icon to display the Screen below. Select the corresponding Hierarchy Values that would be part of the filter.



When you then move to Test (found under the Tools tab), you can select the filter and click the View Query button to see the Sets dynamically created by SAS Information Map Studio.

Test the Information Map

Name of information map: untitled

Data selection for test

Show Rules for Data Selection

Available items:

Show all items

- Sum Of Returns
- Sum Of Inventory
- Sum Of Sales
- Sum Of Stores
- Location
- Product
- US

Selected items:

Item	Role	Properties
Sum Of Retu...	Column	Edit...
Sum Of Inve...	Column	Edit...
Sum Of Sales	Column	Edit...
Sum Of Stores	Column	Edit...
Location	Column	Edit...
Product	Column	Edit...
US	Column	Edit...

Filter Included

View Query

Find...

View Query

Data item description:

OLAP measure Sum Of Returns

Note: You may select only 1 filter from the available items list

Run Test Close Help

View Query

```
WITH
MEMBER [Measures].[&1Sum Of Returns] AS
    '[Measures].[ReturnsSUM]', FORMAT_STRING="DOLLAR12."
MEMBER [Measures].[&1Sum Of Inventory] AS
    '[Measures].[InventorySUM]', FORMAT_STRING="DOLLAR12."
MEMBER [Measures].[&1Sum Of Sales] AS
    '[Measures].[SalesSUM]', FORMAT_STRING="DOLLAR12."
MEMBER [Measures].[&1Sum Of Stores] AS
    '[Measures].[StoresSUM]', FORMAT_STRING="12."
SET [&1Location] AS
    '([Location].[All Location].[United States])'
SET [&1Product] AS
    '[ProdDim].[Product].MEMBERS'
SET [MultipleMeasures] AS
    '([Measures].[&1Sum Of Returns], [Measures].[&1Sum Of Inventory], [Measures].[&1Sum Of Sales], [Measures].[&1Sum Of Stores])'
SET [COL] as
    'CROSSJOIN([MultipleMeasures],CROSSJOIN([&1Location],[&1Product]))'
SELECT [COL] ON COLUMNS
FROM [SampleCube]
```

Sets Created

Close

RECOMMENDATIONS

1. Both MDX, Calculated Members and Proc OLAP Measure statements are extremely efficient and perform essentially the same.
2. Proc OLAP Measure statements and the Cube Measure GUI both require a complete refresh of the OLAP cube. Whereas Calculated Members in 9.1.3SP4 and MDX code can be utilized immediately against the OLAP Cube.
3. The flexibility of Calculated Members and MDX is apparent, offering a wider range of calculation options.
4. One common issue with using complex members/calculations is that they frequently require settings on the OLAP server to be reconfigured in order to prevent users from hitting memory or processing constraints. Configuration changes and optimizations include:
 - a. Increasing the MEMSIZE setting in the OLAP Server Configuration File
 - i. This configuration file is located at
 \Lev1\SASMain\OLAPServer\sasv9_OLAPServer.cfg
 - ii. The default MEMSIZE is 512M.
 - b. Increasing the maximum number of tuples per query in the OLAP server:
 - i. <http://support.sas.com/kb/19/363.html>
 - c. Creating an ARM log and running it through the Advanced Aggregation Tuning plugin within OLAP Cube Studio or DI Studio.
5. Adding Measures and Defining SETS in an Information Map slows performance significantly and is not recommended by our consultants.

ADDITIONAL READING

SAS Global Forum Paper "Beyond the Basics: Advanced OLAP Techniques" 219-31

<http://www.zencos.com/pdf/219-31.pdf>

OLAP Server Administration Guide

http://support.sas.com/documentation/onlinedoc/91pdf/sasdoc_91/olap_admin_7001.pdf

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the author at:

Angela Hall
Zencos Consulting LLC
100 Regency Forest Dr, Suite 130
Cary, NC 27518
Work Phone: 919-459-4600
Angela.Hall@Zencos.com
<http://www.zencos.com>

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.
Other brand and product names are trademarks of their respective companies.