

onestream

# BI Blend Design and Reference Guide

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8.2.4 Release

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# BI Blend Overview

BI Blend is a “read-only” aggregate storage model designed to support reporting on large volumes of data that is not appropriate to store in a traditional OneStream Cube. BI Blend data is large in volume and most often transactional in nature. As an example, to analyze data by invoice, a standard cube would require metadata to store the data records. In a short period of time, most all the invoice metadata would be unneeded because of the transactional nature of the data. Therefore, storage in a Cube design is not a best practice solution for transactional data.

A key challenge to report on Transactional data is to present it in a uniform format supporting standardized reporting yet be flexible enough to support ever changing records and reporting requirements. The overall large size of the data sets requires a model suitable for responsive reporting and analysis.

BI Blend is a solution that approaches these challenges in a unique and innovative way. It is a solution that rationalizes the source data for uniform and standardized reporting, much like the Standard OneStream Cube models, but stores the data in a new relational column store table for responsive reporting.

The BI Blend solution is intended to support analytics on large volumes of highly changing data, such as ERP system transaction data, which typically would not reside in a OneStream Cube. The processing is unencumbered from the intensive audit controls within a traditional Consolidation Cube, such as managing Calculation Status.

## Key Elements of BI Blend

- Flexible for change
- Fast Aggregation (through data as Stored Relational Aggregation)
- Single Reporting Currency translation
- Leveraged OneStream Metadata, Reporting and Integration tools
- Non-Cube, executed to a relational table optimized for reporting on large data sets by storing results in a column store index

## **BI Blend Features**

BI Blend is a blend of Multidimensional and Transactional Data. This is done by utilizing the OneStream platform application to generate a database structure for OLAP reporting. By utilizing the existing OneStream Workflow processes, users need to be familiar with the interface and tools required to develop BI Blend reporting solutions.

BI Blend provides focused reporting tables that are aggregated and saved as stored parent intersections for fast reporting at a later point in time. BI Blend does not replicate an entire cube, but rather focuses on specific reporting use cases that result in many parent intersections that would not perform well under Calc-On-Fly aggregation.

BI Blend also solves for use cases that are not pure analytic reporting problems. By leveraging OneStream hierarchies along with BI Blend configuration settings, it is possible to aggregate on a few dimensions (entity or account for example) while including transaction information (Invoice number) that is not associated with a cube. The ability to combine the dimensional structure with transaction details allows for selective enrichment of transactional data.

BI Blend is designed to support analytic models where some level of aggregation may be required, but contains constantly changing information that should not be loaded to a cube. This includes the following items:

- Read only access data
- Very large data sets that are transactional in nature
- Fast aggregation as stored relational aggregation
- Flexible and changing records
- Data related to cube data
- Data populated and rebuilt on demand
- Ancillary and supplemental data

## **BI Blend Stage Cache Engine**

BI Blend uses in-memory processing and does not write-records to stage tables. All results are output to the designated target database. This engine is used to rationalize the transactional data by leveraging the OneStream Metadata Engine. During processing the BI Blend Cache will utilize the Cube dimensions to transform the records into a unified reporting format. The Cube Hierarchies are used to derive aggregation points to be stored for reporting.

The BI Blend Stage Cache will also accept properties on Entities and Accounts to perform direct method translation to the application reporting currency. The Engine ultimately generates a finalized table with a Column Store Index, creating a structure for OLAP reporting. The table can be accessed with the standard OneStream BI Dashboard and Pivot Grid reporting tools for analytic reporting as well as Relational Blending into Cube Views and Dashboards.

The BI Blend Stage Cache Engine supports:

- Hierarchy Aggregation without complex calculations
- Simple currency translation using the Direct Method only. Any destination currency can be defined, but only one per BI Blend process.
- Limited use of member properties
- Does not use dimension relationship properties such as Aggregation Weight, Percent Consolidate, or Percent Ownership
- Limited parent level calculations using derivative rules
- Basic time math using helper rules
- Supports simultaneous multi-period data loads by record for up to 12 periods using Attribute Value dimension Members

The Stage Engine integrates transactional data. Source data is processed through the standard Stage Engine, where the data uses the common OneStream tools to parse and transform records. BI Blend source data contains additional members that are defined in the integration as Attribute members. Stage Derivative Rules enhance the data with groupings available in reporting.

# BI Blend Configuration Overview

BI Blend is designed around all the common elements used in all OneStream applications. It does not require additional training. Any users familiar with setup, Workflow and Reporting will be comfortable using BI Blend as it utilized all the functionality around:

- Data Integration
- Metadata
- DataSources
- Transformation Rules
- Derivative Rules
- Workflows
- Reporting tools and Dashboards

## Workflow and Cube Settings

The Cube Dimensions assigned to the Cube are used by the BI Blend Stage Cache Engine to define the target for transforming records. The assigned Cube Dimension's hierarchies will generate the aggregation points for the resulting BI Blend Relational Table. This is a primary difference between the BI Blend Model and a Standard OneStream Cube Model. Within each Data Unit, the parent levels, such as an Account parent, are derived dynamically in the Standard OneStream Cube Model. The BI Blend Model will derive these totals and save them as stored values in the output relational table.

The interface to the BI Blend Model is the OneStream Workflow interface. Workflow is a key element of BI Blend. Workflow BI Blend settings establish the Cube Dimensions that are used to derive the metadata and aggregation points in the resulting BI Blend Relational Tables.

The data integration used by the BI Blend Engine uses dimensionality based on cube dimensions, stage attributes, and BI Blend extended dimensions. This array of properties, which is available for data integration, lets the designer enrich the source data for reporting.

BI Blend extended dimensions are a component of the BI Blend engine Blend X extended architecture which consists of three dimensions that provide an additional 57 fields to capture text, numeric values, and time. The Blend X extended architecture uses the Attribute DateTime dimension to deliver time-awareness to the data set which is then used by calculations to enrich data for reporting:

- 13 cube dimensions let transformation rules align source records to cube data and to generate aggregation points based on the dimension hierarchies.
- 20 stage text attributes text records support cube dimension aggregations when the records are aligned with metadata in a User Defined 8 dimension. They do not support the use of transformation rules.
- 12 stage value attributes support numeric records.
- 3 label dimensions are text-based fields. The SourceID field is the key record attribute used to partition the records for multi-threading aggregations and for the processing of derivative rules.
- 13 Blend X Attribute DateTime Dimension fields are designed to capture time-based fields. The xBlendDateTime field usage is extended to function as the time-based property in Derivative Rule computational math functions.
- 20 Blend X text attributes expand the scope of the data set.
- 24 Blend X value attributes capture numeric data or time-series values in a matrix load format.

In the below example, the Integration settings on the cube are enabled for Attribute1 and Attribute2 to expand the details to be collected for BI Blend analytic reporting, such as and Invoice Number and Customer Code.

## BI Blend Configuration Overview

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The screenshot shows the BI Blend Configuration Overview interface. The top navigation bar includes tabs for Cube Dimensions, Cube References, Data Access, and Integration. The main content area is divided into three sections: Cube Dimensions, Label Dimensions, and Attribute Dimensions. The Cube Dimensions section lists various entities, views, accounts, flows, and user-defined dimensions. The Label Dimensions section includes Label, SourceID, and TextValue. The Attribute Dimensions section lists Attribute1 and Attribute2. A Settings panel on the right side shows options for Alias, Transformation Sequence, and Enabled status.

Entity	Account	Flow	IC	Products	GLSourceSys	InvoiceNum	CustCode	Amt
G22	100000233	EBAL	K234	GP	IVC2289895	PetShop	104,005.00	
G22	100000233	EBAL	C400	GP	IVC2289900	PetShop	2,040,505.00	
G22	100000233	EBAL	E799	GP	IVC2289905	PetShop	398,995.00	
G22	100235563	EBAL	C600	GP	IVC2289910	SportsComplex	29,844,556.00	
G22	290000000	EBAL	C400	GP	IVC2289915	GolfCenter	546,888.00	
G22	345603400	EBAL	C400	GP	IVC2289920	GolfCenter	235.00	
G99	345603423	EBAL	C400	GP	IVC2289925	GolfCenter	23,445.00	
G99	345603446	EBAL	C400	GP	IVC2289930	DressOutlet	1,345.00	
G99	345603469	EBAL	G478	GP	IVC2289935	DressOutlet	2,355,662.00	
G99	345603492	EBAL	G478	GP	IVC2289940	DressOutlet	1,358,543.00	

## Define Aggregation and Report Points

The BI Blend Engine can leverage the hierarchical structure of OneStream dimension metadata hierarchies to generate aggregations. Hierarchy parent levels are created as stored records in the resulting BI Blend tables, adding to the final number of records generated. BI Blend records processed will use transformation rules targeting a cube's assigned dimension.

## BI Blend Configuration Overview

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The dimensions assigned to the integration used by BI Blend, by Scenario Type for example, must contain the base member targets defined in the transformation rules. Therefore, the resulting BI Blend aggregation can differ from that used in other reporting cubes. A dimension and its hierarchy can be unique for BI Blend reporting.

BI Blend requires a cube to determine assigned dimensions. Dimensions by Scenario Type or a specialty cube functioning as a dimension outline can be used to yield alternate reporting results that may differ from standard application cubes.

The BI Blend Stage Cache Engine functionality supports:

- Hierarchy Aggregation, no complex calculations
- Simple currency translation using the Direct Method only. Any destination currency can be defined, but only one per BI Blend process.
- Limited use of Member Properties
- Does not utilize dimension Relationship Properties such as Aggregation Weight, Percent Consolidate or Percent Ownership.
- Limited parent level calculations using Derivative Rules
- Basic Time math using Helper Rules
- Supports simultaneous multi-period data loads by record for up to 12 periods using Attribute Value Dimension Members

## BI Blend Dimension Property Usage

Cube Properties	Cube Dimensions	Cube References	Data Access	Integration
<ul style="list-style-type: none"><li>Actual</li><li>Administration</li><li>Budget</li><li>Control</li><li>Flash</li><li>Forecast</li><li>FXModel</li><li>History</li><li>LongTerm</li></ul>	<ul style="list-style-type: none"><li>► Cube Dimensions</li><li>► Label Dimensions</li><li>► Attribute Dimensions</li><li>► Attribute Value Dimensions</li><li>► BI Blend Extended Dimensions<ul style="list-style-type: none"><li>► Attribute DateTime Dimensions</li><li>► Attribute Dimensions</li><li>► Attribute Value Dimensions</li></ul></li></ul>			<ul style="list-style-type: none"><li>☒ Settings</li><li>Alias</li><li>Transforma</li><li>Enabled</li></ul>

## BI Blend Configuration Overview

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- Scenario Properties
  - The Scenario is defined through the workflow point of view
  - Workflow Tracking Frequency
  - Input Frequency
- Time
  - Time defined in the BI Blend table name is driven off the workflow tracking frequency or based on the Time defined in the source file. Time can be mapped as a matrix load to the attribute value attributes or the Blend X value attributes.
- Entity
  - Currency is referenced for simple Translation
  - No other Member or Relationship Properties are used
  - Aggregation weights are not used and will double count alternate hierarchies
  - BI Blend does not utilize Entity Relationship Properties. Therefore, Entities as a shared member is not supported.
- Account
  - Account Types is used for hierarchical aggregation and translation rates
- Flow
  - Aggregation weights are not used and will double count alternate hierarchies
  - Does not recognize Flow Members impact of Switch Type on Account Types
  - Does not recognize Flow Members impact of Switch Sign
  - Does not support complex currency calculations or alternate input currencies
  - No other Member or Relationship Properties are used
- User Defined

- Does not support data stored as User Defined Attribute Members
- Aggregation weights are not used and will double count alternate hierarchies
- No other Member or Relationship Properties are used
- User Defined 8
  - The UD8 Dimension may contain members, organized in hierarchies, which are used to aggregate Attribute Members contained in the data records.

## Other Dimensions

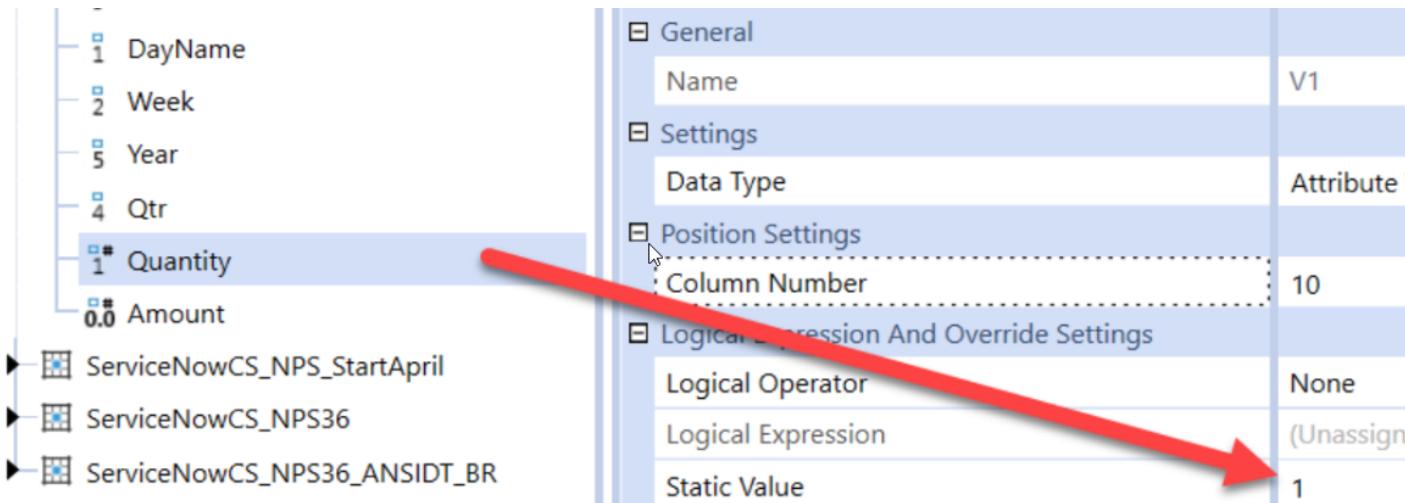
- **Consolidation:** Is limited to functionality for Local and Translation. The results for Translation will be limited to a single target reporting currency per BI Blend process. Complex translation is not supported and only the Direct Method is used for all Account Types.
- **Origin:** The Origin member is only supported for data generated through the Workflow BI Blend Engine as the Import member
- **View:** View is not supported in BI Blend and must be derived in reporting tools or time math business rules. The View dimension is not available or managed in BI Blend. Accumulating results, for YTD reporting, must be done in the reporting tools as a calculation or performed using business rules. The output results of BI Blend include an identifying column identifying the account type to identify flow and balance type accounts.
- **ICP:** ICP Partner detail can be included in the data records, but Eliminations are not performed.

## Attribute Dimensions

External Cube information is collected using the Attribute Dimensions by enabling the fields on the Cube Integration Settings.

A major feature of BI Blend is the ability to utilize Attributes as an element of aggregations. The Attribute Dimensions can be used to contain data record elements, such as “invoice” detail. The Attribute Value is used in solutions to improve performance when loading large data sets for multiple periods (up to 12). In these designs, each Attribute Value is associated with a base period.

Attribute Value dimensions cannot be assigned static values when used with BI Blend workflows.



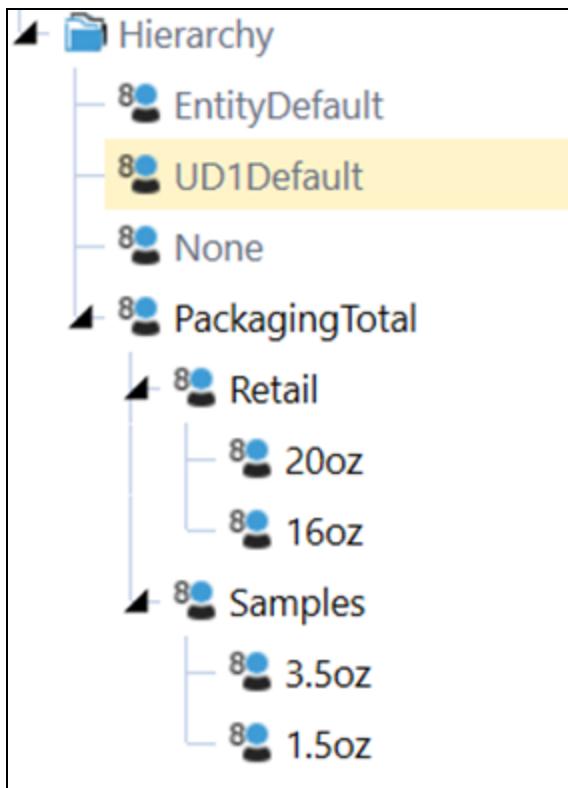
## Attribute Text Dimension

The Cube Integration settings contains 20 Attribute Text Dimensions available for data integration. By associating the imported members of an Attribute Text Dimension to a UD8 metadata hierarchy, BI Blend can generate the aggregated parent level results for reporting. You can manage Attribute Dimension in the following ways:

- Attributes as records can be “aggregated” within a Pivot Grid as a reporting tool feature.
- Aggregations of Attributes can be calculated using BI Blend Derivative Rules.
- Attributes can be associated with a base member UD8 metadata members and aggregated as a member of a hierarchy.

Associating an Attribute with a UD8 base member requires the Attribute Dimension Record exists as a base member in a UD8 Dimension. Only UD8 can be used to generate Attribute Dimension Members for aggregation. Because the record must be reflected as a dimension member, Aggregation Attributes may not be appropriate for highly transactional, changing, record member.

sEntity	sAccount	sUD1	sAtt1	Amt
A300	gl10001	P110	20oz	1000
A300	gl10001	P111	20oz	1000
A300	gl10001	P171	16oz	1000
A300	gl10001	P200s	3.5oz	1000
A300	gl10001	P300s	1.5oz	1000



## Attribute Value Dimension

Cube data integration provides 12 Attribute Value dimension members to capture numeric values. These fields capture Time field values for matrix data files.

## Blend X Attribute DateTime Dimension

The Attribute DateTime dimension members are unique to BI Blend data sources and cannot be used on non-Blend workflow types. These fields are designed to capture Time based fields and have the extended capability to function as time values in derivative rule functions.

To use the DateTime dimension, the data source must have the integrated dimension set as a Blend DateTime data type. The formatting as mm/dd/yy hh:mm is required to support the time-based derivative rule functions.

## BI Blend Configuration Overview

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General	
Name	xDT1
Settings	
Data Type	Blend DateTime
Position Settings	
Column Number	1
Logical Expression And Override Settings	
Logical Operator	None
Logical Expression	(Unassigned)
Date Fill Settings	
Date Format	MM/dd/yyyy hh:mm

Settings include:

- **xBlendDateTime**: This is a special column field used by the BI Blend engine to serve derivative calculations for DataSeries/Time value computations.
- **xBlendTime**: Twelve time column fields to collect additional time calculations that can support date difference calculations.

## Blend X Attribute Text Dimension

Twenty additional text column fields are unique to Blend workflows. These fields are not supported in other non-Blend workflows. Additionally, the Blend X Attribute Text fields do not support extending the records to UD8 for parent level aggregations.

## Blend X Attribute Value Dimension

Twenty-four additional value column fields are unique to Blend workflows and are used to capture numeric values. These fields are not supported in other non-Blend workflows. The Attribute Value fields can be used to map time to create a matrix load. The combination of Attribute Value and Blend X Attribute Value fields provides a maximum time-based matrix load of data at 36 periods.

# Designing BI Blend

Designing the BI Blend Workflow definitions should be determined by understanding how the data will be consumed and analyzed in reporting. The common use of BI Blend will fall into requirements within the models of Transaction Analysis and External Data. However, it can be considered to support an Aggregation model where the BI Blend aggregation processing may be a preferable solution of the standard Cube design.

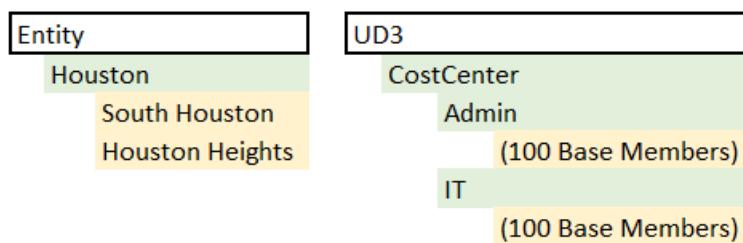
## Blend Unit

Determining which dimension should be defined as the Blend Unit is a key decision which will affect the performance of the BI Blend process and the reporting results.

The Blend Unit acts to define the dimension which used to break down the data into effective pages for processing, or partitions. Blend Unit's partition used to process the aggregations defined in the BI Blend settings, such as Account or UD aggregations.

Each Blend Unit member's aggregations are executed as part of a Multi-Threading process. The selection of the Dimension as the Blend Unit can impact the performance of the application. The larger the number of Blend Unit pages, the more opportunity there is for multi-threading tasks to be initiated.

## Examples



- Entity Structure as three members requires all aggregation to happen within only three members.

- Assigning the larger Dimension as the Blend Unit, such as UD3 (200 members) as the Blend Unit, would allow multi-threading to process more aggregations on smaller datasets.
- Larger Blend Unit members enhance performance through a more even distribution of records.
- When a Blend Unit page completes the aggregation process the engine loops over the rows on the page and summarizes any duplicate rows, but not with duplicates created in another page.
- Derivative rules run on each page, for a single row, in an exclusive manner for that page and do not cross pages.
- Many members in blend unit means more smaller pages which leads to better memory management, faster aggregation performance and more parallel processing.

## Performance Settings

BI Blend processing is a CPU and Memory intensive process. The number of table records is heavily impacted by the Attribute details in the records and level of aggregations defined for Cube Dimensions. In each BI Blend configuration setting, the performance can be tailored to the environment with the Performance Controls properties.

- **Max Degree of Parallelism (No SQL):** Defaults to 8 processors
- **Max Degree of Parallelism (SQL):** Defaults to 4 processors
- **Row Limit:** Sets a maximum row limit to return to control potential server queries
- **Application Servers:** Allows a named server to be dedicated for BI Blend processing.

Performance Controls	
Max Degree of Parallelism (No SQL)	8
Max Degree of Parallelism (SQL)	4
Row Limit	10,000,000
Application Servers (optional, use commas and *?)	...

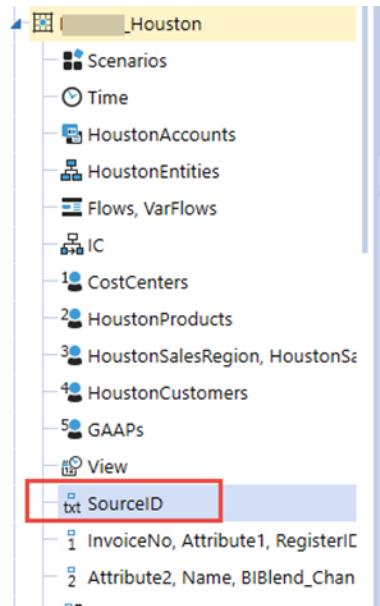
## Blend Unit Partitioning

The concept of partitioning a Blend Unit is a performance solution for large data sets aggregating within a Blend Unit. This permits multithreading of the aggregations within the Blend Unit.

## Designing BI Blend

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Blend Unit Partitioning is accomplished by assigning the Data Source “Source ID” property to a record field. The members within this field will be used as the key to partition aggregations within the Blend Unit page. The resulting records will be not be summarized across the Source ID / Blend Unit partition. Important to note, is the use of Derivative Rules in BI Blend function within a partition and cannot not reference data found in other partitions. If required, the summarization will need to be performed in the database or in the reporting layer.



A	B	C	D	E	F	G	H	I	J	K
srcEntity	srcFlow	srcICP	srcView	srcAccount	srcUD1	srcUD2	srcUD3	srcUD4	srcUD5	srcSourceID
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC100
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC100
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC100
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC100
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC200
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC200
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC200
H200	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	CC200
H210	None	None	YTD	41100	None	HY-LT	1210	ES7349	None	KO001
H210	None	None	YTD	41200	None	IR-LT	1250	AH2347	None	KO001

BI Blend’s assignment of a Blend Unit and aggregation generates “pages”, which are visible in the Log File. Each “Blend Unit Page” cannot exceed 2gb. If the 2gb size is exceeded, the aggregation will fail. The error message “Error Array Dimensions Exceeded Supported Range” will be presented. A solution if impacted by size constraints is to increase the size of the Blend Unit Dimension being used or reduce the number of Dimensions used in BI Blend.

# BI Blend Essential Design Considerations

## Understand Data Records

- Any member not within the data record aggregation path will be bypassed. This means that a datasource can contain a complete set of records. BI Blend can then bypass those records by “filtering” or selecting an aggregation point that excludes those record sets.
- Attribute Members can be aggregated by being associated as a base member in a UD8 hierarchy. If the source record Attribute does not find a base target UD8, no error message is presented, and the record is ignored. This allows the data set to be flexed easily to adapt to reporting changes. Users should review the messaging for bypassed Aggregations. If the member is not within the aggregation path it will be ignored.

## Use of Common Members

Common Members reference metadata designs which have the same member names across dimensions. An example of Common Members is where Dimensions such as UD2 and UD3 both have members called “Top” with children as “None”.

- Caution when using common members (Top / None) across dimensions as the common members may cause inconsistent results.
- If fully summarized intersections are required, the designer should consider selecting another Blend Unit.
- Limiting a Blend Unit to a member may not be optimal for BI Blend processing but will yield fully aggregated dimension results.
- If duplicate records are encountered, accept the duplicates but use aggregation queries when you consume or query the BI Blend Table (Group By on dimensions while performing a sum on Measures).
- Unique top members across dimensions are preferred, change dimension aggregation information to pick a parent that does not include common members, such as None or Top.

## Understanding BI Blend Aggregation

Aggregation is a simple aggregation based on the Cube Dimension hierarchy. Additional aggregation points for non-cube / attribute members can be included in the results using Derivative Transformation Rules.

## Designing BI Blend

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The BI Blend Engine aggregation utilizes the Cube Dimension hierarchies. This is done by evaluating parent members and identifying all Base members within the hierarchy. These base members are aggregated to the parent. Each parent within the hierarchy is evaluated using the same methodology. BI Blend processing has no concept of “sub-parent” rollups. Each parent is evaluated and aggregated according to the base members within its hierarchy.

Entity properties such as “Percent Consolidate” and other Dimension’s “Aggregation Weight” are not used in the BI Blend processing. The aggregation is derived strictly from each Parent as a sum of its base members. Therefore, duplicate members within a hierarchy (shared members), should be avoided to eliminate “double-counting” of results.

BI Blend supports changing the “Blend Unit” from Entity as the “page dimension”, to any other dimension in the Cube. This requires that Currency translation to be defined as a simple translation based on the Cube’s default currency, not the Parent Entity’s currency property. This allows the correct results when the Entity is not the Blend Unit, by providing a common currency throughout the aggregation levels to yield correct results.

Each defined aggregation is stored in a cache, and each can be calculated independently.

Cube	USD
Rate Type Revenues and Expenses	AvgRate
Rate Type Assets and Liabilities	EOMRate

TotalCorporation	NorthEast	NorthEast	SouthEast	Connecticut	Massachusetts
NorthEast	Connecticut	HartfordOffice	HartfordOffice	DaytonaBeachOffice	HartfordOffice
		StamfordOffice	StamfordOffice	FortLauderdaleOffice	StamfordOffice
	Massachusetts	BostonOffice	BostonOffice	AtlantaOffice	BostonOffice
		SpringfieldOffice	SpringfieldOffice	SpringfieldOffice	SpringfieldOffice
SouthEast		DaytonaBeachOffice			
	Florida	FortLauderdaleOffice			
		AtlantaOffice			
		SavannahOffice			
	Georgia	DaytonaBeachOffice			
		FortLauderdaleOffice			
		AtlantaOffice			
		SavannahOffice			

## BI Blend Processing and Performance

The requirements related to the BI Blend environment will vary widely by the volume of source records together with the BI Blend Settings definition.

## Default Server Selection

BI Blend processes will be queued across the available Stage servers. On the BI Blend WorkFlow Settings, a defined server can be assigned to dedicate all BI Blend processing.

## Learning Mode

Learning Mode occurs during the first process instance of BI Blend and the design related to the choice of Blend Unit. This mode restricts multi-threading to two threads by two Blend Units to generate predictive statistics based on the number of records generated from the BI Blend settings. Subsequent processes will be optimized to multi-thread each Blend Unit. Should the Blend Unit be changed, the Learning Mode again be enabled. Additionally, if the number of aggregating dimensions is increased from the prior settings, the Learning Mode will again be enabled.

- Only two threads run
- Default mode when BI Blend Task is run for the first time
- Limited multi-threading is done to help ensure free memory is not exceeded

## Log File Statistics

- Blend Unit
- Base Rows
- Parent Factorial
- Explosion Factor

## Second Pass Processing

After successful learning mode, the same thread can be evaluated. BI Blend processing will observe the current number of rows in each Page Dimension (Blend Unit) and apply the Explosion Factor to determine if the process will exceed the amount of free memory available on the server.

- If a new Blend Unit is added to the file, the calculation estimations for logging and memory usage will use an average across the Page member statistics in its calculations.

# BI Blend Database Table Creation and Structure

The output of BI Blend is an SQL Database table in a Column Store Index format. These are read only fact tables, optimized for reporting by having a high level of compression. The data is highly structured, containing the parent member values, much like Cubes. These tables do not need to be pre-defined or configured. The BI Blend process will create the data tables and corresponding error table automatically.

## OneStream Application Database Tables

A database table captures the activity related to BI Blend tasks. This table has an associated MethodQuery in Dashboard DataAdapter as BIBlendInfo.

- StageBlendInformation table is a table generated in the OneStream application database tables to manage the tables generated through the BI Blend Workflow process

```
SELECT TOP (1000) [Wfk]
  ,[Wsk]
  ,[Wtk]
  ,[TaskActivityID]
  ,[BlendTableDbLocation]
  ,[BlendTableName]
  ,[MapErrorTableName]
  ,[MapErrorsCount]
  ,[FailedCheckRuleCount]
  ,[FailedEventRuleCount]
  ,[BaseRowCount]
  ,[TotalRowCount]
  ,[StatisticsBytes]
  ,[Parameters]
  ,[TimeStamp]
  ,[UserID]
  ,[UserName]
  ,[LiveTotalRowCount]
  ,[LiveTimeStamp]
  ,[LiveParameters]
```

## BI Blend Database Tables

The BI Blend assigned database will have tables created for each BI Blend Workflow Task by Workflow Tracking Frequency. Each time a table is created, a matching “error” table is created. The error table will be created whether or not an error was present.

- BI Blend Table - Each BI Blend task will create a table as:
  - Prefix – “BIB\_”
  - Application Name
  - Workflow Channel Name
  - Workflow Scenario
  - Workflow Time

For example:

 `dbo.BIB_GolfStreamDemo_v18_BIBlend_AdministrationImport_Actual_2018M1`  
 `dbo.BIB_GolfStreamDemo_v18_BIBlend_AdministrationImport_Actual_2018M1_ME`

- BI Blend Error Table – Each BI Blend table will have a corresponding error table:
  - Suffix – “\_ME”

## BI Blend and Cube Settings

A key element of the BI Blend solution is to rationalize data for BI Reporting. The BI Blend Reporting solutions must be tied to a Workflow and the assigned Cube.

### Cube Properties

Currency translation is primarily controlled by the Cube Properties. Rule Type is not used, all translations use the Direct Method. The rate is determined by Account Type.

- RateType for Revenues and Expenses – rate used by Account Type Property
- RateType for Assets and Liabilities – rate used by Account Type Property

## Designing BI Blend

---

Cube Properties	Cube Dimensions	Cube References	Data Access	Integration
<input checked="" type="checkbox"/> General				
<input checked="" type="checkbox"/> Security				
<input checked="" type="checkbox"/> Workflow				
<input checked="" type="checkbox"/> Calculation				
<input checked="" type="checkbox"/> Business Rules				
<input checked="" type="checkbox"/> FX Rates				
Default Currency	USD			
Rate Type For Revenues And Expenses	AverageRate			
Rule Type For Revenues And Expenses	Periodic			
Rate Type For Assets And Liabilities	AverageRate			
Rule Type For Assets And Liabilities	Direct			

## Cube Dimensions

The Cube Dimensions are key to BI Blend results. The assigned Dimensions, by Scenario Type, are used to rationalize the data for reporting and derive the reporting subtotals.

Cube Properties	Cube Dimensions	Cube References	Data Access	Integration
(Default)	<input checked="" type="checkbox"/> Dimensions			
Actual	<input checked="" type="checkbox"/> Entity Dimension	(Use Default)		
Administration	<input checked="" type="checkbox"/> Scenario Dimension	(Use Default)		
Budget	<input checked="" type="checkbox"/> Account Dimension	HoustonAccounts		
Control	<input checked="" type="checkbox"/> Flow Dimension	Flows		
Flash	<input checked="" type="checkbox"/> UD1 Dimension	CostCenters		
Forecast	<input checked="" type="checkbox"/> UD2 Dimension	HoustonProducts		
FXModel	<input checked="" type="checkbox"/> UD3 Dimension	HoustonSalesRegion		
History	<input checked="" type="checkbox"/> UD4 Dimension	HoustonCustomers		
LongTerm	<input checked="" type="checkbox"/> UD5 Dimension	(Use Default)		
Model	<input checked="" type="checkbox"/> UD6 Dimension	(Use Default)		
Operational	<input checked="" type="checkbox"/> UD7 Dimension	(Use Default)		
Plan	<input checked="" type="checkbox"/> UD8 Dimension	(Use Default)		

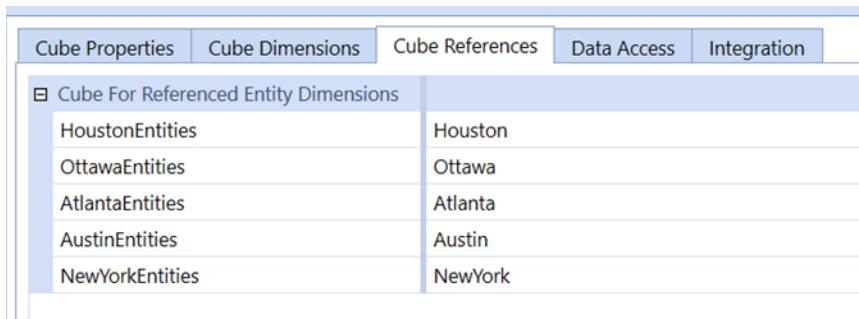
## Cube References

Cube References, and the associated Extensibility they manage, are fully supported by the BI Blend Engine. Extensible Dimension hierarchies will be used if BI Blend is based on a top-level Cube.

## Designing BI Blend

---

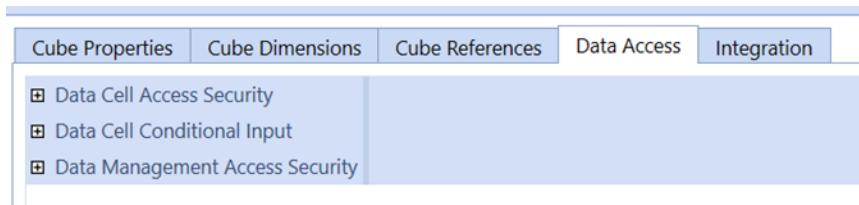
Cube References, and the associated Extensibility related to extended Cubes and Dimensions, have limited support when BI-Blend loads are performed using a top level cube to load to extended cubes. Use of a top level cube to load to Extended Cubes and Dimension only supports two levels of Extensibility. The first being the Cubes Main dimension and the second being the next level extended dimension.



Cube References	
<input type="checkbox"/> Cube For Referenced Entity Dimensions	
HoustonEntities	Houston
OttawaEntities	Ottawa
AtlantaEntities	Atlanta
AustinEntities	Austin
NewYorkEntities	NewYork

## Data Access

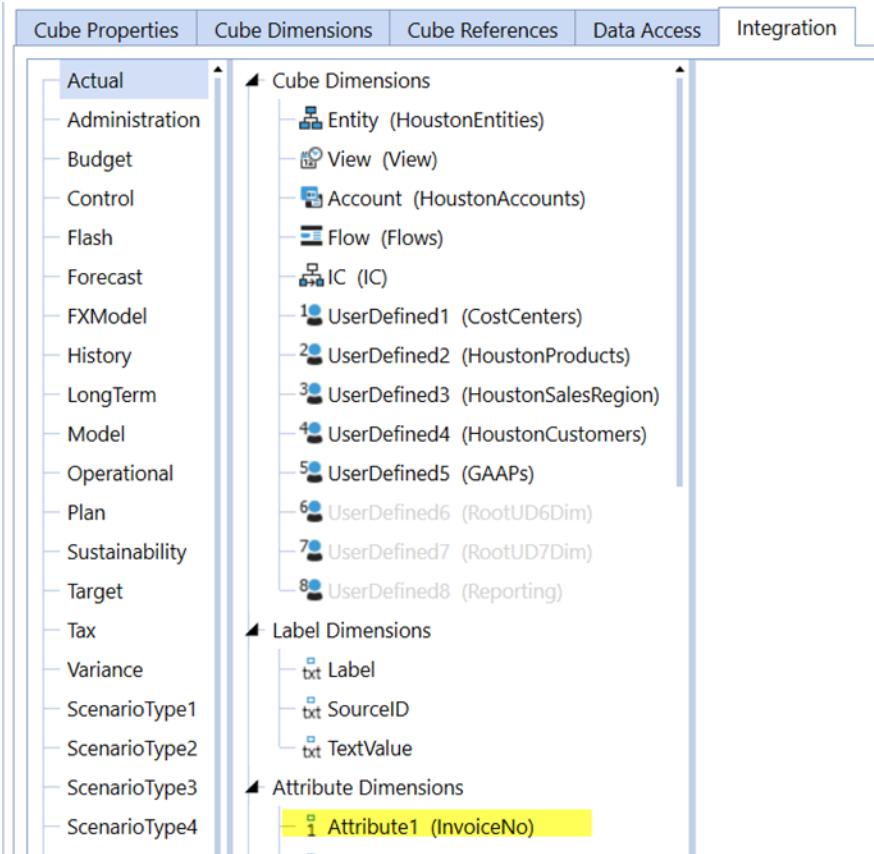
Data Access and other data cell level controls are not supported in BI Blend.



Data Access	
<input type="checkbox"/> Data Cell Access Security	
<input type="checkbox"/> Data Cell Conditional Input	
<input type="checkbox"/> Data Management Access Security	

## Integration

The Integration for the Cube provides the Dimensionality available to the BI Blend Engine. The active Dimensions can be used in both the Transformed and Un-Transformed states just like all Data Integration processes in the standard Stage Processing. The activation of the additional 20 Attribute Dimension members can be activated to support the inclusion of non-cube data in the BI Blend output. The Attribute Value Dimension member can be activated and used in BI Blend to improve performance when loading large volumes of records containing many time periods by allowing all time to be associated by record.



# BI Blend Processing Example

Processing BI Blend used the standard Workflow environment and tools to provide the users with familiar environment and eliminates the need for any additional training.

## Import Blend Data

The Workflow has a new Workflow Name as Blend or Blend as Workspace. You load data the same as other OneStream Workflows that commonly result in Cube data.

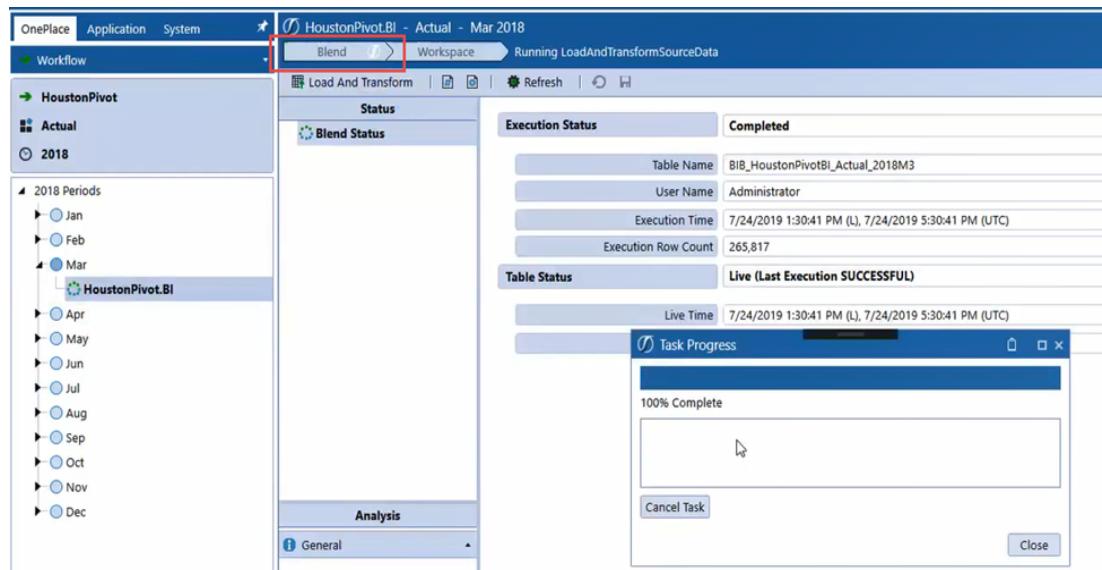
The configuration of BI Blend is managed in the Workflow Profile. However, some of the Stage Engine's Workflow Properties may not be valid, or used in BI Blend configurations. The primary configuration for BI Blend is done using the Workflow Name and BI Blend Settings. The BI Blend Engine's architecture, such as in-memory processing, makes some Workflow properties, such as the Append Default Load Method, an invalid selection. Such selections will not have an effect on Workflow Blend behaviors.

## Designing BI Blend

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Data can be collected from:

- Files (Fixed or Delimited)
- Connectors
- Other Workflow Stage Data

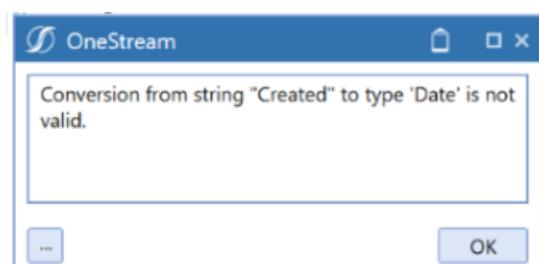


## Delimited Files

When loading data to a BI Blend workflow using a delimited file, a bypass must be used if the first row of the file contains column headers. See the example in the image below. If the bypass was not used in this case, the file would fail to load and would display an error similar to that in the second screen shot.

## Designing BI Blend

The screenshot shows the BI Blend Data Sources interface for a 'ServiceNowCS\_NPS (Bypass)' connection. The left sidebar lists various data sources, with 'Delimited Files' highlighted by a red arrow. The main area displays a table of data with columns: Created, Instance, and Source. The 'Source' column contains entries like 'AINST0038266', 'AINST0037580', etc. Below the table is a configuration panel for a specific source named 'Bp'. The 'Bypass' section is highlighted by a red arrow. The 'Bypass Type' is set to 'Contains At Position' and the 'Bypass Value' is set to 'Created'. The 'General' and 'Settings' sections are also visible.



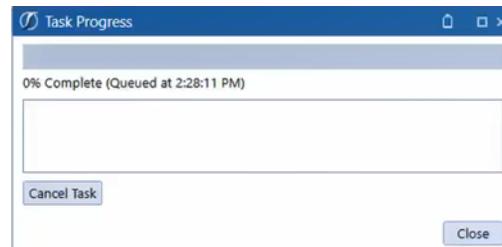
## How to Use a File Bypass

Use a bypass to prevent file load failures in cases where a delimited file contains column headers.

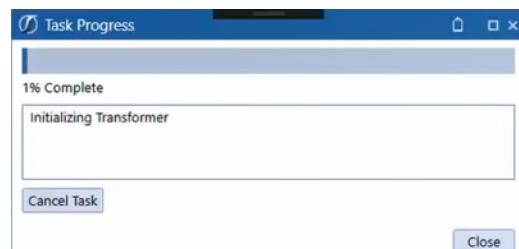
1. Create a bypass:
  - a. Navigate to **Application** tab > **Data Collection** > **Data Sources**.
  - b. Under **Delimited Files**, select a **data source**.
  - c. Click **Create Source Dimension**.
  - d. From the **Name** drop-down menu, select **Bypass**.
  - e. Click **OK**. The default Bypass Type is Contains Within Line.
  - f. In the **Bypass Value** field, type the name of the first column header.
  - g. Click **Save**.
2. Load the delimited file into a BI Blend workflow.

## Blend Steps

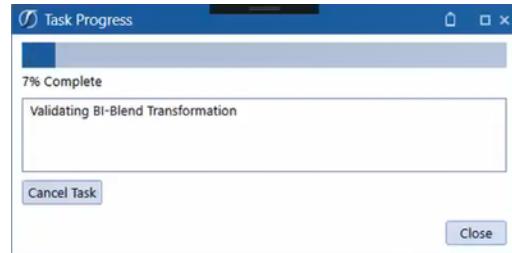
Data is Queued for Processing on a Data Management Server



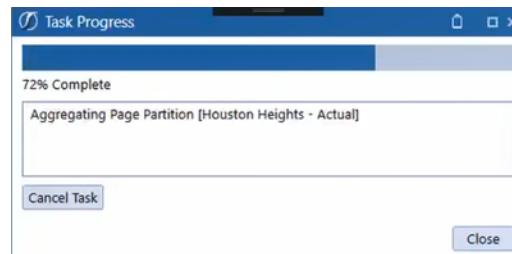
Cube Dimensions are integrated



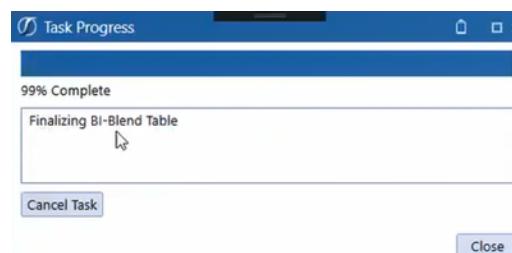
Transformation Rules are executed



Multithreading of Page Dimensions or “Blend Units” begins



Write to target table

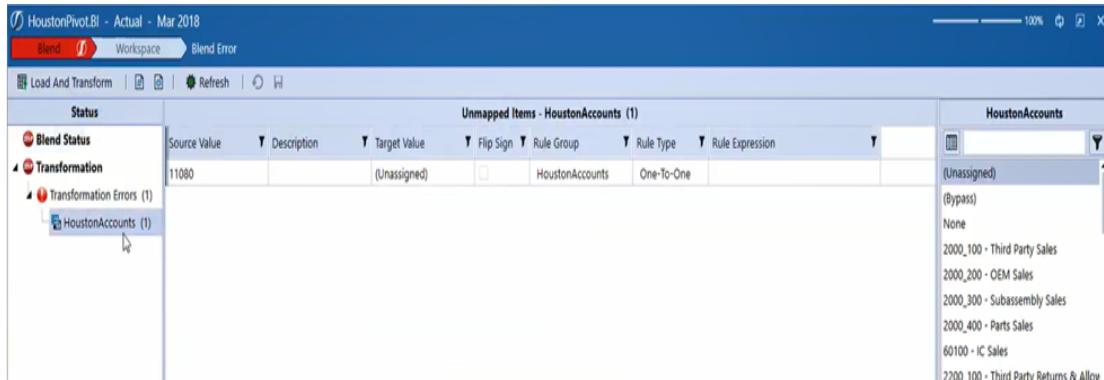


## Validating Members

BI Blend is processing the records in relation to the cube dimensions and the assigned transformation rules to create a common reporting solution. Should any member in a record not find a target in the cube dimension through transformation rules, a mapping error will be presented. Validation is limited to target mapping. Validation of data intersections is not performed, such as those from constraint properties.

## Designing BI Blend

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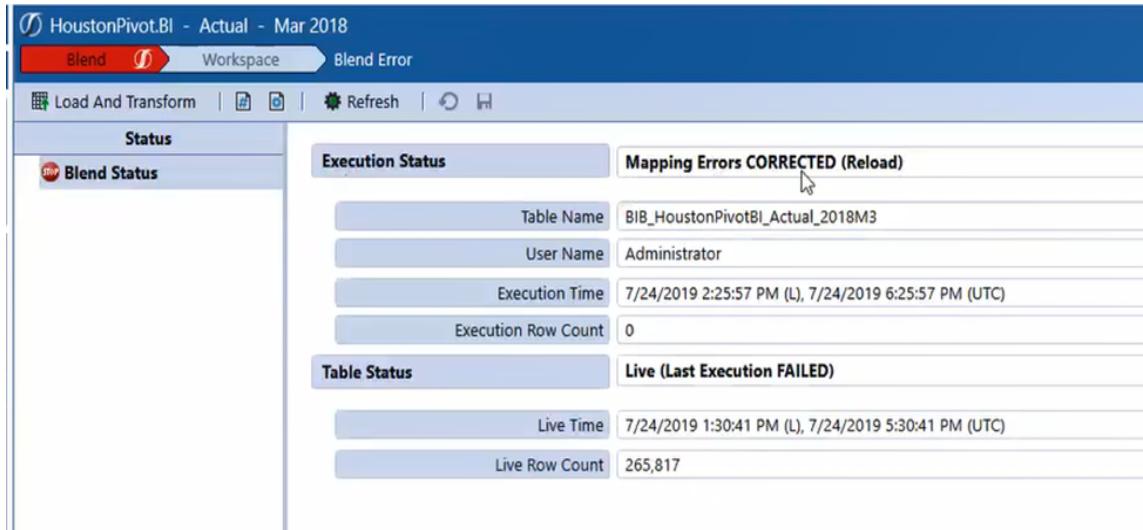


The screenshot shows the BI Blend interface with the 'Blend' tab selected. The main area displays a table titled 'Unmapped Items - HoustonAccounts (1)'. The table has columns: Source Value, Description, Target Value, Flip Sign, Rule Group, Rule Type, Rule Expression, and HoustonAccounts. There is one row with Source Value '11080', Description '(Unassigned)', Target Value '(Unassigned)', Rule Group 'HoustonAccounts', Rule Type 'One-To-One', and Rule Expression empty. The 'HoustonAccounts' column shows a dropdown menu with options: (Unassigned), (Bypass), None, 2000\_100 - Third Party Sales, 2000\_200 - OEM Sales, 2000\_300 - Subassembly Sales, 2000\_400 - Parts Sales, 60100 - IC Sales, and 2200\_100 - Third Party Returns & Allow.

## BI Blend Status

The BI Blend Status page displays the information for the current Blend task. This helps to indicate what results are available. Should there be a failure in the Blend task, the correction must be performed, and the entire task must be re-executed.

- Execution Status: Displays the results of the most current Blend task noting information such as target table name and time. If errors were encountered, the “Reload” status will be displayed to indicate the Blend task must be re-executed.
- Table Status: This status displays the state of current table to denote the last time the table was updated and its size.

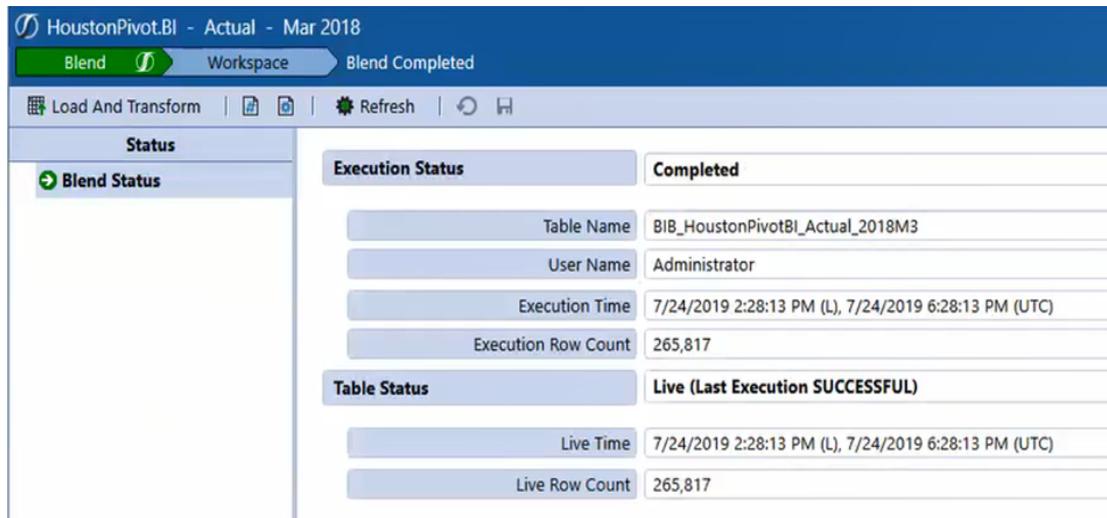


The screenshot shows the BI Blend Status page. The 'Blend Status' section indicates 'Mapping Errors CORRECTED (Reload)'. The 'Execution Status' table shows the following data:

Table Name	BIB_HoustonPivotBI_Actual_2018M3
User Name	Administrator
Execution Time	7/24/2019 2:25:57 PM (L), 7/24/2019 6:25:57 PM (UTC)
Execution Row Count	0

The 'Table Status' table shows the following data:

Live (Last Execution FAILED)	
Live Time	7/24/2019 1:30:41 PM (L), 7/24/2019 5:30:41 PM (UTC)
Live Row Count	265,817



The screenshot shows the BI Blend interface with a blue header bar. The header bar has three tabs: 'Blend' (highlighted in green), 'Workspace' (highlighted in blue), and 'Blend Completed'. Below the header is a toolbar with icons for 'Load And Transform', 'Refresh', and other functions. The main content area is titled 'Status' and 'Blend Status'. It displays 'Execution Status' as 'Completed' and provides detailed information about the task: Table Name (BIB\_HoustonPivotBI\_Actual\_2018M3), User Name (Administrator), Execution Time (7/24/2019 2:28:13 PM (L), 7/24/2019 6:28:13 PM (UTC)), and Execution Row Count (265,817). It also shows 'Table Status' as 'Live (Last Execution SUCCESSFUL)' with a live time of 7/24/2019 2:28:13 PM (L), 7/24/2019 6:28:13 PM (UTC) and a live row count of 265,817.

## BI Blend Processing Logs

Upon the successful completion of a Blend task, statistics and information are written to the log file.



The screenshot shows the BI Blend interface with a blue header bar. The header bar has three tabs: 'Blend' (highlighted in red), 'Workspace' (highlighted in blue), and 'Blend Error'. Below the header is a toolbar with icons for 'Load And Transform', 'Refresh', and other functions. A red arrow points to the 'Refresh' button in the toolbar.

## Basic Log File Parsing

The Log File is intended to provide statistics to manage the Blend task. The source file can identify data records. BI Blend generates records not only by the base member, but also on the parent level hierarchies found in the associated workflow/cube dimensions. The Log File gives insight to this structure to estimate the processing needed on the current and potential future files being processed.

- **Blend Unit:** is the identified dimension used as a partition, generating page records.
- **Base Page Rows:** the number of data record rows for the Page member.
- **Parent Factorial:** total potential data cell intersections available for population at parent level.

## Designing BI Blend

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- **Explosion Factor:** the number of data record cells generated by the base rows across the Dimensions and parent levels.

```
AFTER AGGREGATION
*****
BI-BLEND ENGINE STATISTICS

Houston
  Partitions: 1
  Base Page Rows (Observed): 1,049      [Parent Factorial: 0]
  Base Page Size (Estimate): 490,932    [Bytes/Row (Estimate): 468]
  -----
  Explosion Factor (Observed): 4.9
  -----
  Exploded Page Rows (Observed): 5,163
  Exploded Page Size: (Observed): 2,416,284
  Persist Page (MS): 104
  Update Supporting Metadata (MS): 76

  Partition Processing Durations:
  -----
  RevenueMgmt
    Aggregation (MS): 95
    Summarize (MS): 85
    Derivatives (MS): 0

Houston Heights
  Partitions: 1
  Base Page Rows (Observed): 224      [Parent Factorial: 0]
  Base Page Size (Estimate): 108,416    [Bytes/Row (Estimate): 484]
  -----
  Explosion Factor (Observed): 6.0
  -----
  Exploded Page Rows (Observed): 1,344
  Exploded Page Size: (Observed): 650,496
  Persist Page (MS): 128
  Update Supporting Metadata (MS): 23

  Partition Processing Durations:
  -----
  RevenueMgmt
    Aggregation (MS): 93
    Summarize (MS): 16
    Derivatives (MS): 1
```

## Task Activity

A new Task Activity status has been added to monitor BI Blend processes called BI Blend Load and Transform. This tracking breaks out the various processing steps for analysis.

## Designing BI Blend

Task Activity						
Task Type	Description	Duration	Task Status	User	Application	
Cube View	Example1_UD_UD	0:00:00.027	Completed	Admin	Attribute	
Cube View	Example1_UD_UD	0:00:00.180	Completed	Admin	Attribute	
Bi-Blend Load And Transform	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:13.173	Completed	Admin	GolfStreamDemo	
Bi-Blend Load And Transform	Task Steps (10 Items)					
Bi-Blend Load And Transform	Step Type	Description	Duration	Thread Id	Processing Information	
Bi-Blend Load And Transform	InitializeTransformer	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.268	118	Page Size=20000, Pages Limit=200, Parallel Xform=16, Parallel Scan=16	
Bi-Blend Load And Transform	ParseConnector	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.07.019	118	Connector=RevenueMgmtHouston	
Bi-Blend Load And Transform	EvaluateDataCache	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.00.024	118	Data Pages=2, Data Rows=20980, Data Keys=1, Invalid Data=0, Invalid Rows=0	
Bi-Blend Load And Transform	ExecuteDerivativeRules	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.01.424	118	Source: Rule Groups=1, Rules=3	
Bi-Blend Load And Transform	ExecuteTransformationRules	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.00.589	118	Thread Batch Count=16	
Bi-Blend Load And Transform	InitializeBiBlendEngine	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.01.046	118	Type=TargetCubeDims, Translate=False, Base Rows=20980	
Bi-Blend Load And Transform	ValidateBiBlendTransformation	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.00.094	118	Status=Completed, Unmapped Items=0, Failed Check Rows=0	
Bi-Blend Load And Transform	AggregateBiBlendTableCache	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.00.760	118	Blend Unit=E#, Top Member=Houston, Member Count=1, Cache Size=10,944	
Bi-Blend Load And Transform	FinalizeBiBlendTable	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.00.581	118	Rows=10,494, Table=B1B_GolfStreamDemo_v18_BiBlend	
Bi-Blend Load And Transform	PostFileArchives	WP#BiBlend_Administration.Import\$#Actual:T#2018M1	0:00:00.00.042	118	Rows=10,494, Table=B1B_GolfStreamDemo_v18_BiBlend	

## Technical Overview

### BI Blend Workflow Settings

The primary design element of BI Blend are the BI Blend Settings found on the Workflow Import Channel by Scenario Type. These settings allow the BI Blend administrator to define and optimize the generation BI Blend tables to meet the reporting requirements.

Data Controls	
Measure Type	TimeWFView
Content Type	TargetCubeDims
Create Star Schema	False
Database Location / External Connection	BIBlendReporting
Data Explosion Adjustor	1
Column Aliases (Name Value Pairs)	U1T=CostX,U2T=Houston Products,U3T=Houston Sales,U4T=Houston Customers

BI-Blend Settings	
Data Controls	
Measure Type	TimeWFView
Content Type	TargetCubeDimsAttributes
Create Star Schema	False
Database Location / External Connection	BIBlendReporting
Data Explosion Adjustor	1
Column Aliases (Name Value Pairs)	U2T=HoustonProducts,U3T=HoustonSalesRegion,U4T=HoustonCustomers

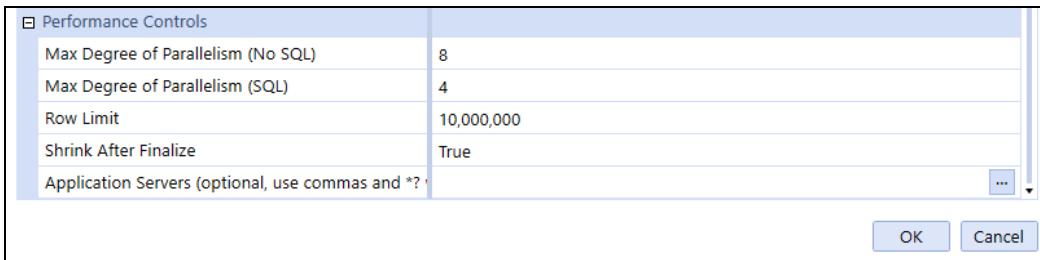
## Designing BI Blend

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Aggregation Controls	
Translate	NotUsed
Blend Unit Dimension Token	E#
Entity Aggregation Info	NA Clubs;Children
Account Aggregation Info	62000;TreeDescendants
IC Aggregation Info	NotUsed
Flow Aggregation Info	NotUsed
UD1 Aggregation Info	NotUsed
UD2 Aggregation Info	Top;Member
UD3 Aggregation Info	NotUsed
UD4 Aggregation Info	NotUsed
UD5 Aggregation Info	NotUsed
UD6 Aggregation Info	NotUsed
UD7 Aggregation Info	NotUsed
UD8 Aggregation Info	NotUsed
Attribute 1 Aggregation Info	NotUsed
Attribute 2 Aggregation Info	NotUsed
Attribute 3 Aggregation Info	NotUsed
Attribute 4 Aggregation Info	NotUsed
Attribute 5 Aggregation Info	NotUsed
Attribute 6 Aggregation Info	NotUsed
Attribute 7 Aggregation Info	NotUsed
Attribute 8 Aggregation Info	NotUsed
Attribute 9 Aggregation Info	NotUsed
Attribute 10 Aggregation Info	NotUsed
Attribute 11 Aggregation Info	NotUsed
Attribute 12 Aggregation Info	NotUsed
Attribute 13 Aggregation Info	NotUsed
Attribute 14 Aggregation Info	NotUsed
Attribute 15 Aggregation Info	NotUsed
Attribute 16 Aggregation Info	NotUsed
Attribute 17 Aggregation Info	NotUsed
Attribute 18 Aggregation Info	NotUsed
Attribute 19 Aggregation Info	NotUsed
Attribute 20 Aggregation Info	NotUsed

## Designing BI Blend

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Setting	Function
Measure Type	Defines how the time dimension column will be determined in the relational tables.
Content Type	Controls the type and level of detail displayed in the relational tables for base level records only (analysis of source against aggregated parents is not supported). The designer controls how the BI Blend tables utilizes dimension hierarchies and the inclusion of Attributes related to the Cube Integration Settings.
Create Star Schema (Optional)	Creates the output as a Star Schema table set and related Views. Supporting Dimension tables will be created for each Cube Dimension assigned an Aggregation Control. The Dimension tables will contain column fields for <b>MemberName</b> , <b>MemberDesc</b> , <b>NameAndDesc</b> , <b>ParentName</b> , <b>IndentLevel</b> , <b>IsBase</b> and <b>MemberSeq</b> , which can be used in reporting against the Star Schema view. This is an optional setting.
DB Location	Sets the name of the SQL Database that holds the BI Blend results tables.
Explosion Adjustor	Estimates the size of tables generated, as derived from the initial Learning Mode.

Setting	Function
Column Alias	Defines custom column names for the output database table. Spaces in the names are not recommended. Use underscores to represent spaces.
Translate	Enables translation to a single destination currency.
Blend Unit Token	Token to assign a Dimension to partition as a Page Dimension and the basis of the BI Blend multi-threading.
Dimension Aggregation	Parent member point to set top level aggregation member. Can be set as a parent level, children, list, distinct member or no aggregation.
Max Degree Non SQL Parallelism	The default setting is 8.
Max Degree SQL Parallelism	The default setting is 4.
Row Limit	Estimated by analyzing the Blend Log File, base level rows, and the Explosion factor to determine free memory usage.
Shrink After Finalize	Compacts the BI Blend database upon table finalization. The default setting is “True”.
Application Servers	The BI Blend processes default to the Stage Servers, with queuing controls. This can be overridden with named servers.

## BI Blend Settings

**Measure Type** - Determines how time will be assigned in the BI Blend Table. Time is always generated as a database column based on the file contents or Workflow settings.

- **TimeSource** – Create Time columns by the time referenced from members found as records in the source file.
- **TimeWFView** – Time columns are generated from the Workflow Tracking frequency. As an example, a yearly tracking frequency for a monthly input scenario would create 12 time columns regardless of the number of periods in the data records. This option is used for Time Math helper rules.
- **TimeWFViewAV** – This type uses the Attribute Value Dimension. This solution requires time based value records to be associated with Attribute Value Dimension members in the data source. Each value (1-12) is associated with a time period column in the output table. This method is efficiently processes records in large multi-period datasets.

**Content Type** - Lets the designer determine the record detail that will be written to the BI Blend tables. Cube dimensions, such as Entity Account and User Defined, are supported by Source and Target, or transformed, results. The designer can also include or exclude the attribute or BI Blend Extended Dimensions.

- **TargetCubeDims** – Results will be limited to the transformed cube dimension target members.
- **TargetCubeDimsSource** – Results will include both the source and transformed cube dimension target members.
- **TargetCubeDimsAttributes** – When data is integrated to attribute dimensions for non-cube dimension records, such as invoices assigned as an attribute, TargetCubeDimsAttributes must be used to process and include the detail. Results are transformed Cube target members including Attributes.
- **TargetCubeDimsAll** – Output to table provides all available Source, Target and Attribute results.
- **TargetCubeDimsAttributesEx** – Results will include the transformed cube dimension targets and the BI Blend extended dimensions.
- **TargetCubeDimsAllEx** - Output to table provides all available source, target and attribute and BI Blend Extended Dimension results.

**CreateStarSchema** – Generate the BI Blend database as Star Schema, required for Leveled Hierarchy reporting.

**ColumnAlias** – Provided functionality to rename the output table columns using the stage table keywords. If left blank, the system generates column names based on the default table and dimension labels.

Prefix Alias Keys:

- User Defined: U1T through U8T
- Attributes: A1 through A20
- Attribute Values: V1 through V12
- Label: Lbl
- TextValue: Tv
- Blend X Attributes: xA1 through xA40
- Blend X Attribute Value: xV13 through xV36

Example: to custom label columns for User Defined Dimensions and a Stage Attribute

U1T=CostCenter,U2T=Products,U3T=Regions,A1=DepartmentCode,A2=ExpenseID

**Translate** - Translation can be defined as any destination currency. Entity and Account must have a member defined for Aggregation Info to determine the local currency and rates to use. Only the direct method is applied based on the rates defined on the cube settings, determined by account type. No complex currency translation is supported, by sub-parent levels. All Entities will be translated to the destination currency.

**Blend Unit Token**- Assigns the Cube Dimension as the partitioning dimension to generate as pages and the corresponding level of multithreading. Available dimensions for Blend Unit are:

MaxMembersDim	Setting will evaluate the source and assign the largest member set as the Blend Unit
E#	Entity
F#	Flow
U1-U8	User Defined
A1-A20	Attribute Dimensions

**Aggregation Controls** – Used to set the parent level for the top-level aggregation. The intent of these filters is to limit the return of records to the parents that need aggregation for reporting. The complete dataset will be used, however, records outside any defined aggregation path will be ignored. As an example, if an aggregation control for Entity was set for US Clubs, any records present in the dataset for Entities outside the US Clubs hierarchy will be ignored. This allows BI Blend to generate results focused on specific reporting and analysis requirements.

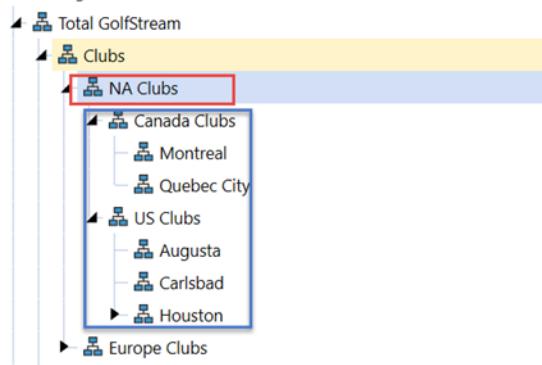
When using BI-Blend with extended dimensions, BI-Blend will ONLY aggregate the ultimate base members of an extended dimension. Loading a member that becomes a parent as a result of dimension inheritance, such as mapping source data to a parent member, will result in NO aggregation for the extend parent.

## Aggregation Info Settings

NOTE on Filtering – Applying Aggregation Information Filters will return both the Filtered Parents and the base member records. The exception to this behavior is related to the when the Blend Unit Dimension uses the ;Member filter. The “Member” filter on a Blend Unit dimension will return only that member.

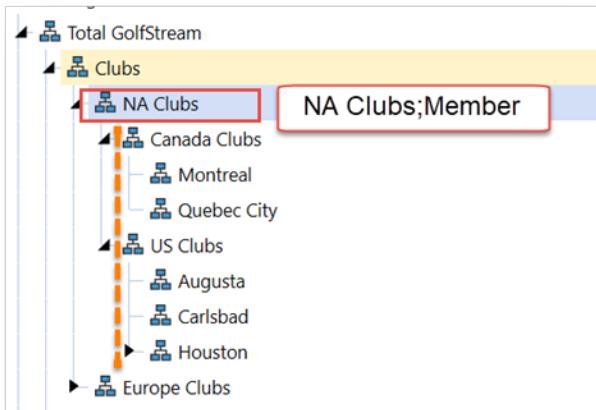
- **Not Used** - This will not include any parent level members in the results. The records will be collected at the row record level detail if included in the Data Source.
- **Parent Level Selection** - Selecting a single parent will limit the records to the members within that hierarchy and generate records for all members with data within the hierarchy. Selecting NA Clubs would create records for NA Clubs as TreeDescendantsInclusive.

Aggregation Controls	
Translate	NotUsed
Blend Unit Dimension Token	E#
Entity Aggregation Info	NA Clubs
Account Aggregation Info	60999



- **Parent Level Selection, as Member** – The dimension assigned as the Blend Unit can be restricted to return a summary parent member. This is a situation where the results are only required at an aggregated parent. By entering the setting as NA Club;Member, all the descendant's results will be aggregated to the parent, but the descendant members will not be included in the output. This option for a specified Parent Members is only available on the Blend Unit. For non-Blend Unit dimensions, using ;Member will return the Parent Member defined, as well as all the base members found within the parent member's hierarchy.

Aggregation Controls	
Translate	NotUsed
Blend Unit Dimension Token	E#
Entity Aggregation Info	NA Clubs;Member
Account Aggregation Info	60999
IC Aggregation Info	None



- **Parent Level Selection, Children** – Focuses aggregation points to a member's children. The selection of NA Clubs;Member.Children property will return the Children of the Parent member as Children Inclusive. Alternatively, NA Clubs;Children can be used as a “non-inclusive” filter. Base members are also returned.
- **Parent Level Selection, TreeDescendants** – This is a non-inclusive option written as NA Clubs;TreeDescendants.

- **Star Schema Only** – When “Create Star Schema” is set to “True” the SSOnly filter can be used, NA Clubs;SSOnly. This setting will not generate parent level records in the BI-Blend data table. The “SSOnly” Aggregation Control will create a complete Star-Schema Dimension table containing fields MemberName, MemberDesc, NameAndDesc, ParentName, IndentLevel, IsBase and MemberSeq for Cube Dimension hierarchy as specified by the parent member in the Aggregation Control.
- **Star Schema Leveled Hierarchy** – The “SSLeveled” property, CostCenters;;;SSLeveled, requires “Create Star Schema” is set to “True”. If enabled, the corresponding Star-Schema Dimension table will have zero-based column fields added, which correspond to the hierarchical structure of the dimension. Not valid for use on Account and Attributes. See the section on Leveled Hierarchy.

**NOTE:** Aggregation point or member must be defined on the Blend Unit dimension.

- **Reporting Labels as Name, Description or Name and Description** – By default, any Dimension set as an Aggregation will return the results using the Name field found in the Dimension properties. To modify the results, the Dimension or Attribute must be used as an Aggregation Control. Using the label properties on a standard, non-Star Schema, BI Blend table will replace the record with the labeling method. The delimited field for the label can be modified as:
  - N – Name
  - D – Description
  - ND – Name and Description
- Cube Dimension Aggregation Control Syntax
  - TopMember;RestrictMember;Labels;StarSchemaControl  
Houston;;;ND  
Houston;Member;ND  
Houston;Member.Children;D  
Houston;;;SSLeveled

Attribute Dimension Syntax, the number of fields is larger because to the inclusion of the Dimension Name.

- Dimension Name; TopMember;RestrictMember;Labels  
UD8BlendAttributes;Contracts;;D  
UD8BlendAttributes;Contracts;Member;D

## Leveled Hierarchy

Leveled hierarchy is for aggregation reporting where parent values reflect the aggregation points. It is activated as a BI-Blend Aggregation Control impacting the Star-Schema Dimension tables with the creation of Leveled and IsBaseBIBlend column fields. Leveling adds the hierarchy context that is useful in Pivot Grid and custom Dashboard reports.

### Syntax

- TopMember;RestrictMember;Labels;SSLeveled
- Clubs;;;SSLeveled

Aggregation Controls	
Translate	NotUsed
Blend Unit Dimension Token	E#
Entity Aggregation Info	CoreRegions
Account Aggregation Info	ServiceSales
IC Aggregation Info	NotUsed
Flow Aggregation Info	NotUsed
UD1 Aggregation Info	US
UD2 Aggregation Info	Clubs;;;SSLeveled
UD3 Aggregation Info	NotUsed

The column fields generated by the “SSLeveled” property will be created to the maximum depth of the hierarchy, starting from the defined parent to the base member. The leveled columns will only be created on base members and their ancestors where data is populated in the BI-Blend data table. Levels greater than those containing data will not be created. The property is not valid for use on Account and Attribute Aggregation Controls.

The leveling process will generate two field placeholders.

- **XFLeveled** - Created only on base-level records for data intersections whose hierarchy is less than the maximum depth
- **XFStored** – Created only on parent level members. This represents the data intersection of stored-parent values created by the BI-Blend engine

## Leveled Hierarchy Processing

The “SSLeveled” property enables the generation of the hierarchy leveling fields. Efficiency is accomplished by limiting the leveling only to members that contain data in the BI-Blend data table. However, leveling is an additional process used by the BI-Blend Engine which will affect the overall BI-Blend processing time.

## Star-Schema Leveling Column Fields

The “SSLeveled” property enabled generates new columns in corresponding Star-Schema Dimension Tables. BiBlend will ONLY aggregate the ultimate base members of an extended dimension. Loading a member that becomes a parent as a result of dimension inheritance will result in NO aggregation for the extend parent.

- IsBIBlendBase: Reflects the hierarchy status of where the actual data records exist. Restricts the creation of leveling only on members that contain data in the data table. Designates the member as a base (1) or parent member (0) by the usage in the BI-Blend data table.
- Level x: Zero-based to maximum descendent depth only on member where BI Blend data exists.

**NOTE:** The BI Blend leveled hierarchy is only available for star schema-enabled workflows.

## Example: Using the Leveled Hierarchy in the Large Data Pivot Grid

In the example below, the table has a hierarchical view.

## Designing BI Blend

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Large Pivot Grid   Leveled Large Data Pivot   BI Blend Adapter

Leveled Large Pivot Grid

				CoreRegions	
				ServiceSales	
				USGeography	
Clubs	Irons	Hybrids	Extended_Hybrid1	XFLeveled	1,000.00
		Extended_Hybrid2	XFLeveled	1,000.00	
		XFStored	XFStored	2,000.00	
Clubs	Wedges	Extended_Wedges1	XFLeveled	1,000.00	
		Extended_Wedges2	XFLeveled	1,000.00	
		XFStored	XFStored	2,000.00	
Clubs	XFStored	XFStored	XFStored	4,000.00	
		Extended_Belly1	XFLeveled	1,000.00	
		Extended_Belly2	XFLeveled	1,000.00	
Clubs	Belly	XFStored	XFStored	2,000.00	
		Extended_Conventi...	Extended_Conventi...	1,000.00	
		XFStored	XFStored	2,000.00	
Clubs	Conventional	XFStored	XFStored	2,000.00	
		Extended_Conventi...	Extended_Conventi...	1,000.00	
		XFStored	XFStored	2,000.00	
Clubs	Long	Extended_Long1	XFLeveled	1,000.00	
		Extended_Long2	XFLeveled	1,000.00	
		XFStored	XFStored	2,000.00	

Hidden Fields

- Dimensions
- Measures

Filter Area

- Scenario
- View
- Flow
- Origin
- UD2

Row Area

- UD2\_Level\_0
- UD2\_Level\_1
- UD2\_Level\_2
- UD2\_Level\_3
- UD2\_Level\_4

Column Area

- Entity
- Account
- UD1

Data Area

- 2020M1

Defer Layout Update   Update

Notice in this example the items labeled “XFStored” indicate that the table is being “leveled” to create leveled columns based on the maximum depth of hierarchy from the BI-Blend data.

Leveled Large Pivot Grid					▲ CoreRegions
					▲ ServiceSales
					USGeography
		▲ Hybrids	▲ Extended_Hybrid1	XFLeveled	1,000.00
		▲ Hybrids	▲ Extended_Hybrid2	XFLeveled	1,000.00
		▲ Hybrids	▲ XFStored	XFStored	2,000.00
	▲ Irons	▲ Wedges	▲ Extended_Wedges1	XFLeveled	1,000.00
	▲ Irons	▲ Wedges	▲ Extended_Wedges2	XFLeveled	1,000.00
	▲ Irons	▲ Wedges	▲ XFStored	XFStored	2,000.00
	▲ Irons	▲ XFStored	▲ XFStored	XFStored	4,000.00
▲ Clubs	▲ Putters	▲ Belly	▲ Extended_Belly1	XFLeveled	1,000.00
▲ Clubs	▲ Putters	▲ Belly	▲ Extended_Belly2	XFLeveled	1,000.00
▲ Clubs	▲ Putters	▲ Belly	▲ XFStored	XFStored	2,000.00
		▲ Conventional	▲ Extended_Conventi...	Extended_Conv...	1,000.00
		▲ Conventional	▲ Extended_Conventi...	Extended_Conv...	1,000.00
		▲ Conventional	XFStored	XFStored	2,000.00
		▲ Conventional	▲ XFStored	XFStored	2,000.00
		▲ Long	▲ Extended_Long1	XFLeveled	1,000.00
		▲ Long	▲ Extended_Long2	XFLeveled	1,000.00
		▲ Long	▲ XFStored	XFStored	2,000.00

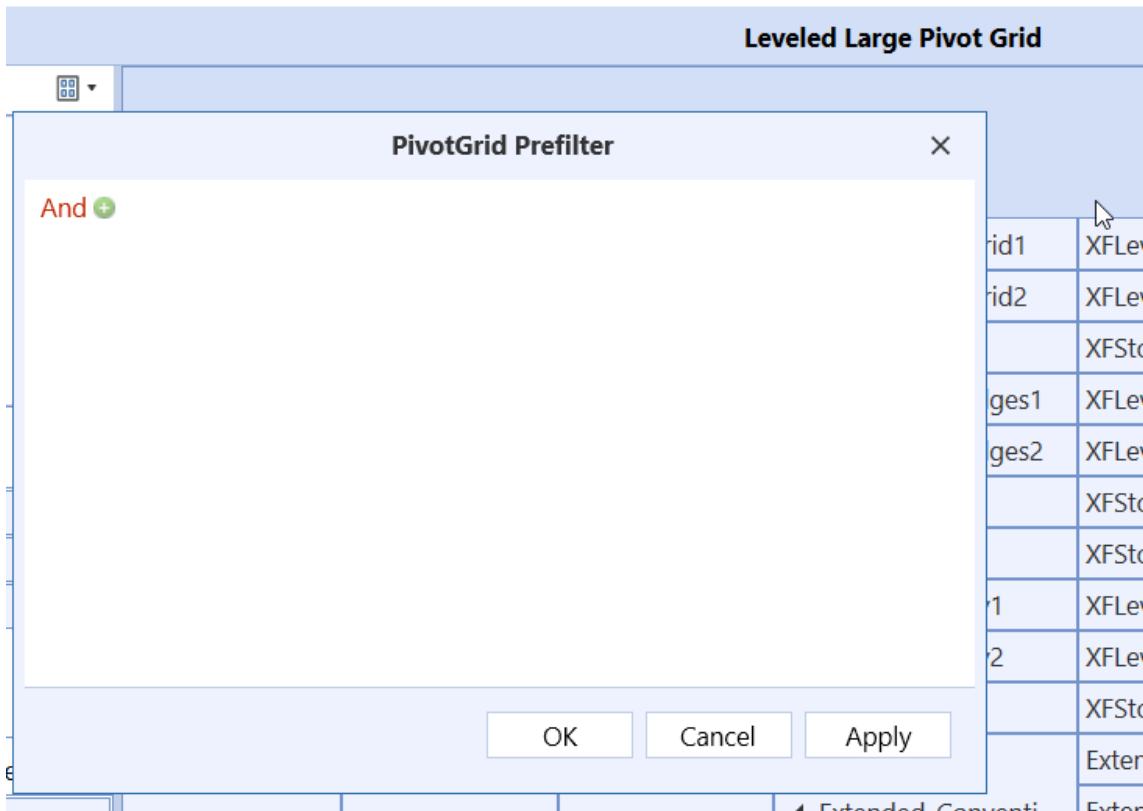
## Setting IsBIBlendBase

Use the IsBaseBIBlend parameter to show where actual data records exist in the table.

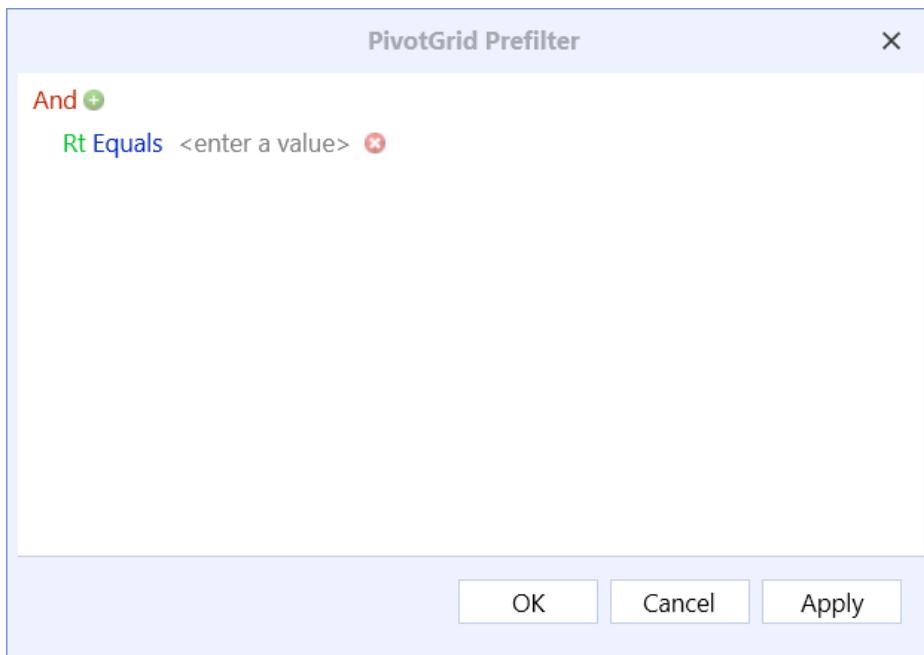
1. From the Leveled Large Pivot Grid, right-click in the blue row and select Show Prefilter.

Leveled Large Pivot Grid			CoreRegions	ServiceSales	USGeography
		Hybrids	XFLeveled	1,000.00	
			XFLeveled	1,000.00	
			XFStored	2,000.00	
		Extended_Wedges1	XFLeveled	1,000.00	

The PivotGrid Prefilter dialog box opens.



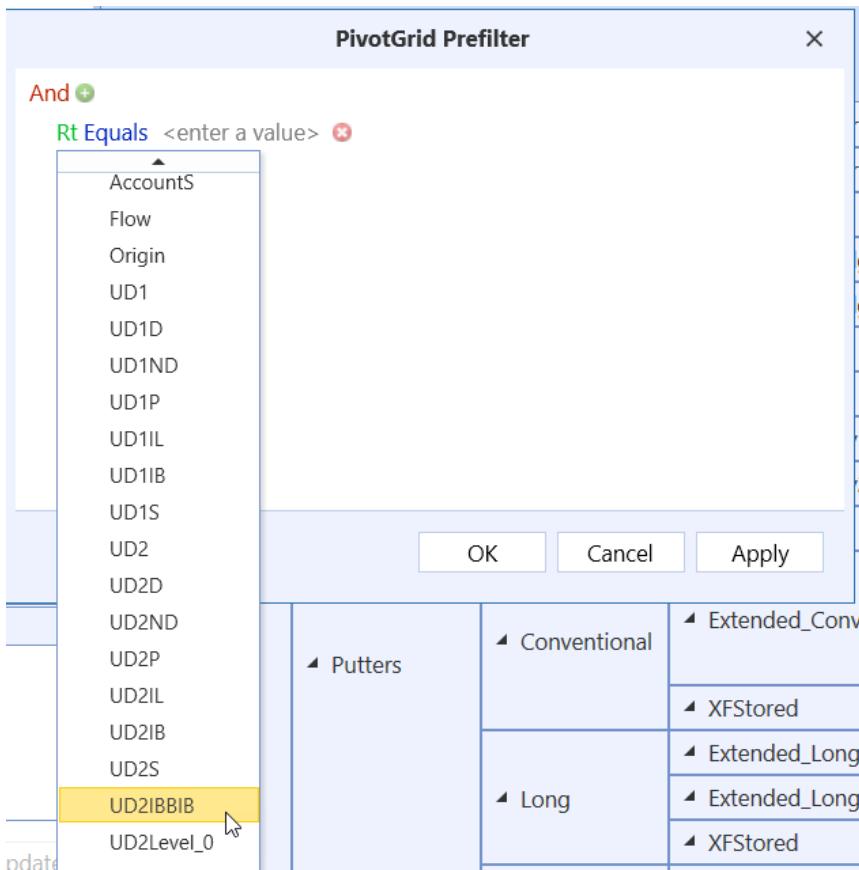
2. Click the green +.



3. Click Rt and scroll through the list to select UD2IBBIB.

## Designing BI Blend

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4. Click <enter a value> and type 1.
5. The equation looks like this:



6. Click OK.
7. After applying IsBaseBIBlend, the leveled table now changes to show only those rows that contain actual data (XFLeveled) and has removed the rows that were added for leveling (XFStored).

Leveled Large Pivot Grid					
					▲ CoreRegions
					▲ ServiceSales
					USGeography
▲ Clubs	▲ Irons	▲ Hybrids	▲ Extended_Hybrid1	XFLeveled	1,000.00
			▲ Extended_Hybrid2	XFLeveled	1,000.00
		▲ Wedges	▲ Extended_Wedges1	XFLeveled	1,000.00
			▲ Extended_Wedges2	XFLeveled	1,000.00
		▲ Belly	▲ Extended_Belly1	XFLeveled	1,000.00
			▲ Extended_Belly2	XFLeveled	1,000.00
	▲ Putters	▲ Conventional	▲ Extended_Conventi...	Extended_Conv...	1,000.00
				Extended_Conv...	1,000.00
		▲ Long	▲ Extended_Long1	XFLeveled	1,000.00
			▲ Extended_Long2	XFLeveled	1,000.00

8. Click **Save** to save your changes.

## BI Blend Application Setup

### External Database Connection

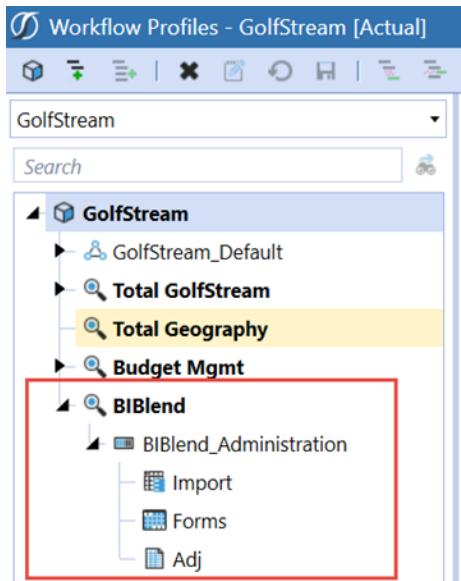
The BI Blend target table must be a separate external database, that is not in the Application Database. You will update the Application Server Configuration Utility to confirm a connection to the new BI Blend target database.

### Set Up Workflow for BI Blend

1. Create a Workflow structure to manage BIBlend. Apply the appropriate Security groups as required. (Administrator)

## Designing BI Blend

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2. Select the Import channel to Blend, by Scenario Type
  - a. **Blend**: Limited to the BI Blend data processing
  - b. **Blend – Workspace**: Additional support to display Workspace Dashboards

BIBlend_Administration.Import - Properties [Actual]		
(Default)	<input checked="" type="radio"/>	General
Actual	<input type="radio"/>	Name: BIBlend_Administration.Import
Administration	<input type="radio"/>	Description:
Budget	<input type="radio"/>	Access Group: Everyone
Control	<input type="radio"/>	Maintenance Group: Everyone
Flash	<input type="radio"/>	Workflow Execution Group: (Use Default)
Forecast	<input type="radio"/>	Certification SignOff Group: (Use Default)
FXModel	<input type="radio"/>	Workflow Settings
History	<input type="radio"/>	Workflow Channel: (Use Default)
LongTerm	<input type="radio"/>	Workflow Name: Blend
Model	<input type="radio"/>	Workspace Dashboard Name (Custom Workflow): (Use Default)
Operational	<input type="radio"/>	Profile Active: True
Plan	<input type="radio"/>	Integration Settings

## Designing BI Blend

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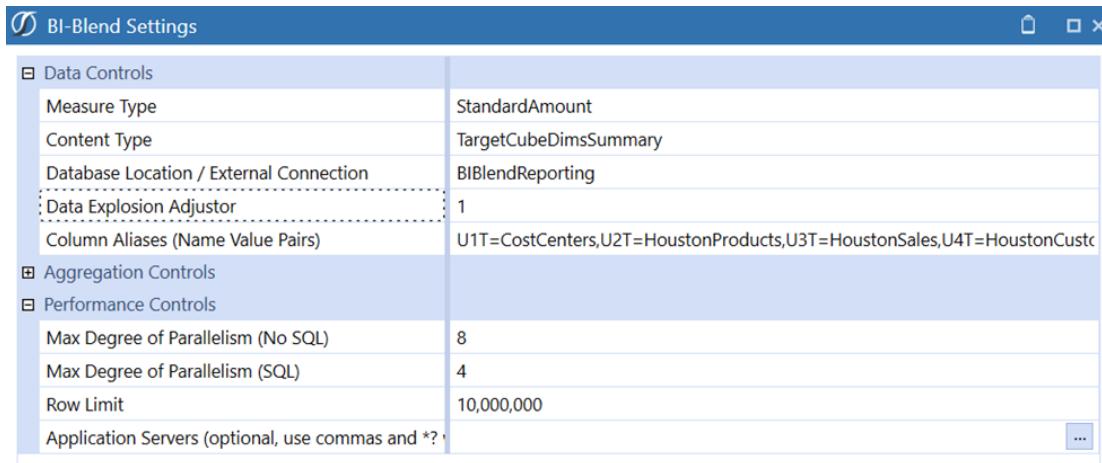
3. If designing BI Blend as a Workflow Process, Dashboards can be assigned through the Validate Profile.

Workflow Settings	
Workflow Channel	(Use Default)
Workflow Name	Blend
Workspace Dashboard Name (Custom Workflow)	OnePlace BI Blend Example Workspace - BI Blend OnePlace
Profile Active	True
Integration Settings	
Data Source Name	HoustonRevMgmt
Transformation Profile Name	HoustonSalesDetail
Import Dashboard Profile Name	(Use Default) 
Validate Dashboard Profile Name	(Use Default) 
Is Optional Data Load	(Use Default)
Default Load Method	Replace
Limit To Defaults	False
Insert Type	Bulk
Can Load Unrelated Entities	(Use Default)

4. Assign the DataSource and Transformation Rule Profile which BI Blend will utilize to derive the metadata and subtotals in the resulting table

Integration Settings	
Data Source Name	HoustonRevMgmt
Transformation Profile Name	HoustonSalesDetail
Import Dashboard Profile Name	(Use Default)

5. Set the BI Blend Parameters which is a collection of properties which define the BI Blend process defined in this document.



# Calculations

Enrichment of the data processed by the BI Blend engine can be performed through the in-memory processing of records, or at run-time using workspace data adapters. The use of existing metadata hierarchies is an optimal solution to add parent level aggregations and reporting points to the data set. Derivative Rules enrich the data set with time-based and other calculations. Run-time calculations can be designed into Dashboard SQL Data Adapters. The inclusion of aggregations and calculations adds to the record count of BI Blend processed data sets.

# BI Blend Derivative Rules

A special category of Derivative Rules is designed for the BI Blend Engine. The calculation of each derivative rule is performed within the Blend Unit. The calculations within the Blend Unit partition cannot reference data found in other Blend Unit partitions. If required, the summarization will be performed in the database or reporting layer.

The dependency of calculations on the Blend Unit is an important factor to consider when designing a BI Blend Workflow. There are three classes of derivative rules specifically designed for the BI Blend engine:

- **BlendUnit All:** Rules will process on all Blend Units.
- **BlendUnit Base:** Rules will process only on hierarchy base-level Blend Units.
- **BlendUnit Parent:** Rules will process only on parent-level Blend Units.

The use of each class of derivative rules depends on the design of the Blend Unit in the Workflow BI-Blend Settings. First, determine which dimension is used to derive the Blend Unit by the **Blend Unit Dimension Token** selection. Second, understand and review the selection made for the corresponding dimensions **Entity Aggregation Info**.

Parent level members create base and parent level partitions. If a base-level member is selected, only a single partitioned Blend Unit page is created, and BlendUnit All is used to define the derivative rules.

Aggregation Controls	
Translate	NotUsed
Blend Unit Dimension Token	E#
Entity Aggregation Info	Clubs
Account Aggregation Info	60000
IC Aggregation Info	NotUsed

## Time-Aware Derivative Logical Operators

Blend X Derivative statistical computations filter records by time filters. This lets you develop dynamic, standardized calculations to group records by time that function across all data sets. Time filtering is keyed off the primary date field **xBlendDateTime**, as **xBDT**, for data series statistical calculations.

### Date Grouping

Date groupings are appended to the Blend X time-aware functions to dynamically filter the records by a date range. The criterion for the range includes the start and end range, as well as the grouping level.

#### Expression Syntax for Statistical Grouping

`xBDT:[<Start DateTime>~<End DateTime>]!GroupingLevel {Y, HY, Q, M, W, D ,TH, TM, TS}`

#### Grouping Expression Example

`xBDT:[YYYY-MM-DD hh:mm:ss~YYYY-MM-DD hh:mm:ss]!Y`

#### Example

`A#[TicketCost]=Stats_SumCost:A1#[*]=None:A2#[*]=None:A4#[*]=None:xBDT#[2022-01-01 00:00:00~2022-12-31 23:59:59]!Y`

All records within the Blend Unit are filtered by the range. Results are generated at the level of detail defined in the Grouping Level. As an example, grouping a full year data set by "Y" will return a single result for each year in the data set. Similarly, specifying "Q" will return four quarterly records.

### Grouping Row / DataSeries Relationship

Type	Date	Value	
Grouping Group!Y	12/31/2023	200	Grouping Level - Yearly
Data Series (Data Points)	Date	Value	
	1/1/2023	50	DataSet Level - Original Date (Data Point)
	4/1/2023	50	DataSet Level - Original Date (Data Point)
	5/1/2023	50	DataSet Level - Original Date (Data Point)
	6/1/2023	50	DataSet Level - Original Date (Data Point)

## Rolling Time-Aware Filters

Rolling time-aware filters are appended to the Blend X time-aware functions to dynamically calculate rolling calculations. All records within the Blend Unit are filtered by range. The syntax references the date, operation for the range, and grouping level. A fixed date or variable is supported.

### Expression Syntax for Rolling Date

`xBDT:[<D-X>~<Ref DateTime>]!GroupingLevel {Y, HY, Q, M, W, D, TH, TM, TS}`

### Rolling Date Example

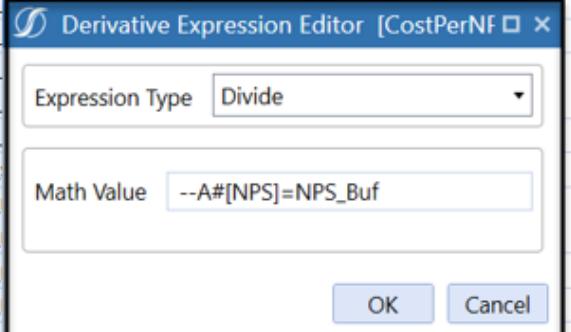
`xBDT:D-90~YYYY-MM-DD hh:mm:ss]!Y`

### Example

`A#[TicketCost]<<MySuffix_ :A1#[*]=None:A2#[*]=None:A4#[*]=None:xBDT#[  
[CurrentDateTimeLocal~D+6]!Y`

## Data Buffer Logic

The Blend X logical operators support data buffer math. Calculation operations are not restricted to defined constants. The secondary buffer is applied to the **Math Value** field in the complex expression.



The screenshot shows a table of derivative expressions and a dialog box for editing a specific expression. The table rows are as follows:

CostPerNPS_Math.N	GR-Buffer Divide - Math	A#[TicketCost]=Math_TCPerNPS	Divide
CostPerNPS_Code.N	GR-Buffer Divide - Code	A#[TicketCost]=Math_TCPerNPS	Complex Expression
ABS_Math.N	GR-ABS	A#[TicketCost]=Math_TCPerNPS	Absolute Value
Round_Math.N	GR-Round	A#[TicketCost]=Math_TCPerNPS	Round (Precision)
Modulo_Math.N	GR-Modulo (Bound Value)	A#[TicketCost]=Math_TCPerNPS	Modulo (Divisor)
Power_Math.N	GR-Power (Exponential Value)	A#[TicketCost]=Math_TCPerNPS	Power (Exponent)
SumCost_Stats.E	GR-Sum (Data Grouping)	A#[TicketCost]=Stats_Sum	None
ProportionCount.N	GR-Proportion Count	A#[TicketCost]=Stats_ProportionCount	Proportion (Count)
ProportionValue.N	GR-Proportion Value	A#[TicketCost]=Stats_ProportionValue	Proportion (Value)
LogP1.N	GR-LogP1 Smoothing	A#[TicketCost]=Stats_LogP1	Log (P+1)
LogP1.Code	GR-LogP1 Code	A#[TicketCost]=Stats_LogP1	Complex Expression
ClipLower.E	GR-ClipLower Value	A#[TicketCost]=Stats_ClipLower	Clip (Lower Bound)

## Blend X Derivative Naming Convention

BI Blend table results maintain account type references for data records. When enriching the data set using derivative rules, the rule naming convention property functions to properly apply Account Type to each of the data records generated. Account Type prefixes are as follows:

- **R:** Revenue
- **E:** Expense
- **N:** Non-Financial
- **A:** Asset
- **L:** Liability

## Logical Operator Definitions

### Add

Adds the derivative member's value by the value set in the **Math Value** field.

### Subtract

Subtracts the value specified in the **Math Value** field from the derivative member's value.

### Multiply

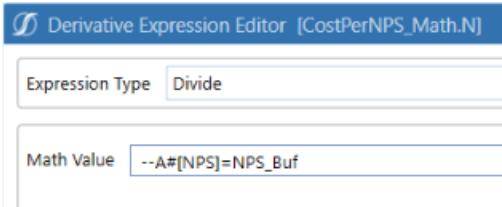
Multiplies the derivative member's value by the value specified in the **Math Value** field.

### Divide

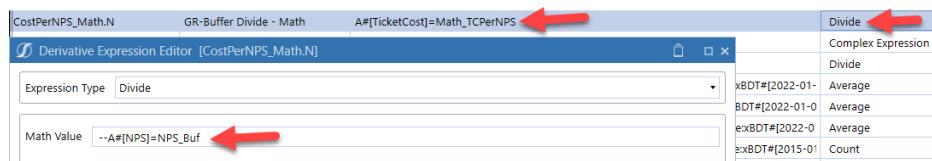
Divides the derivative member's value by the value specified in **Math Value**. You can also use a buffer value as shown in the following image:

## Designing BI Blend

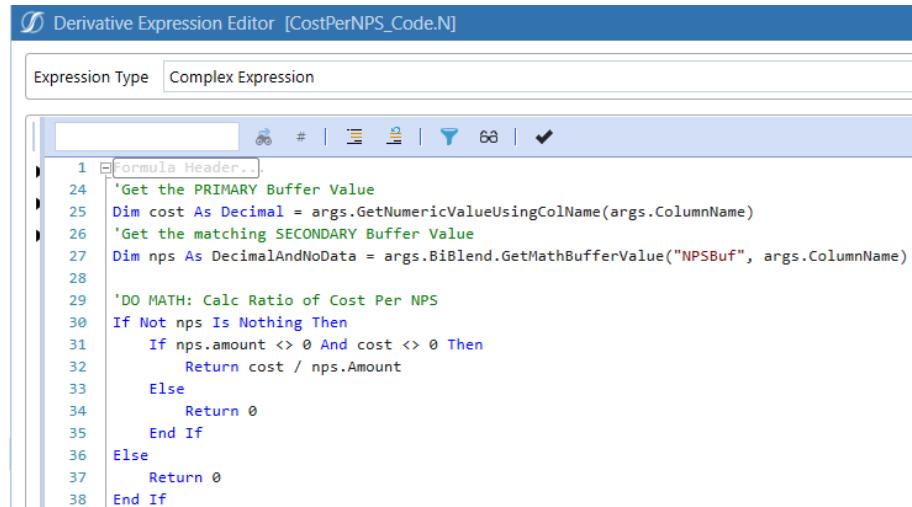
---



In this case, accounts named TicketCost in the load file are targeted. These accounts are renamed to Math\_TCPerNPS.



This is the complex expression that performs the division. The MathBufferValue amount is captured for the NPS account. The values for the original TicketCost account records are then divided by the value of the NPS account:



### Lag (Years)

Returns the past value (lag) per the number of years set in the **Math Value** field of the rule. **Math Value** = 1 by default. The lag operator looks at the first date in the set, then returns the lag value for the number of years specified. In the data set shown below, the value 12 would be returned if the **Lag (Years)** value is set to 1:

Created	AV1
1/31/2022 23:47	65.88
1/1/2022 23:47	1.99
12/31/2021 23:47	9.99
12/30/2021 23:47	14.57
12/29/2021 23:47	53.72
1/31/2021 23:47	12

### Lag (Months)

Returns the past value (lag) per the number of months set in the **Math Value** field of the rule.

**Math Value** = 1 by default. The lag operator looks at the first date in the set, then returns the lag value for the number of months specified. In the data set shown below, the value 9.99 would be returned if the **Lag (Months)** value is set to 1:

Created	AV1
1/31/2022 23:47	65.88
12/31/2021 23:47	9.99

### Lag (Days)

The Lag (Days) logical operator returns the past value (lag) per the number of days set in the **Math Value** field of the rule. The data set is first sorted in descending order by the Created date. The lag operator looks at the first date in the set, then returns the lag value for the number of days specified. In the data set shown below, the value 23.39486017 would be returned if the **Lag (Days)** value is set to 2:

Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12
1/31/2022 22:47	17.77
1/31/2022 21:47	43.53177343
1/30/2022 23:47	101.55
1/29/2022 13:45	23.39486017
1/28/2022 23:47	6.67
1/27/2022 8:02	25.51319627

### Lag (Hours)

Returns the past value (lag) per the number of hours set in the **Math Value** field of the rule. The data set is first sorted in descending order by the Created date/time. The lag operator looks at the first date/time in the set, then returns the lag value for the number of hours specified. In the data set shown below, the value 43.53177343 would be returned if the **Lag (Hours)** value is set to 2:

Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12
1/31/2022 22:47	17.77
1/31/2022 21:47	43.53177343
1/30/2022 23:47	101.55

### Lag (Minutes)

Returns the past value (lag) per the number of minutes set in the **Math Value** field of the rule. The data set is first sorted in descending order by the Created date/time. The lag operator looks at the first date/time in the set, then returns the lag value for the number of minutes specified. In the data set shown below, the value 21.12 would be returned if the **Lag (Minutes)** value is set to 4:

Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12

### Lag (Seconds)

Returns the past value (lag) per the number of seconds set in the **Math Value** field of the rule. The data set is first sorted in descending order by the Created date/time. The lag operator looks at the first date/time in the set, then returns the lag value for the number of seconds specified. In the data set shown below, the value 17.77 would be returned if the **Lag (Seconds)** value is set to 3600 (60 minutes):

Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12
1/31/2022 22:47	17.77

### Lag Change (Seconds)

Returns the difference between the latest value and a past value (lagged value), per the number of seconds set in the **Math Value** field of the rule. The data set is sorted in descending order by the Created date/time. The lag change operator looks at the first date/time in the set, then looks at the lag value based on the number of seconds set in the rule. The difference between the latest value and the lag value is returned. In the data set shown below, the value -2.25 would be returned if the Lag Change (Seconds) value is set to 3600 (60 minutes):

15.51544 - 17.77 = -2.25	
Created	Actual value
1/31/2022 23:47	15.51544
1/31/2022 23:43	21.12
1/31/2022 22:47	17.77

### Lag Change (Minutes)

Returns the difference between the latest value and a past value (lagged value), per the number of minutes set in the **Math Value** field of the rule. The data set is sorted in descending order by the Created date/time. The lag change operator looks at the first date/time in the set, then looks at the lag value based on the number of minutes set in the rule. The difference between the latest value and the lag value is returned. In the data set shown below, the value -5.60 would be returned if the **Lag Change (Minutes)** value is set to 4:

15.5154439 - 21.12 = -5.60	
Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12

### Lag Change (Days)

Returns the difference between the latest value and a past value (lagged value), per the number of days set in the **Math Value** field of the rule. The data set is sorted in descending order by the Created date/time. The lag change operator looks at the first date/time in the set, then looks at the lag value based on the number of days set in the rule. The difference between the latest value and the lag value is returned. In the data set shown below, the value 8.85 would be returned if the **Lag Change (Days)** value is set to 3:

15.5154439 - 6.67 = 8.85	
Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12
1/31/2022 22:47	17.77
1/31/2022 21:47	43.53177343
1/30/2022 23:47	101.55
1/29/2022 13:45	23.39486017
1/28/2022 23:47	6.67

### Lag Change (Months)

Returns the difference between the latest value and a past value (lagged value), per the number of months set in the **Math Value** field of the rule. The data set is sorted in descending order by the Created date/time. The lag change operator looks at the first date/time in the set, then looks at the lag value based on the number of months set in the rule. The difference between the latest value and the lag value is returned. In the data set shown below, the value -3.37686333 would be returned if the **Lag Change (Months)** value is set to 1:

12.13858057 - 15.5154439 = -3.37686333	
Created	Actual value
2/28/2022 23:47	12.13858057
1/28/2022 23:47	15.5154439

### Lag Change (Years)

Returns the difference between the latest value and a past value (lagged value), per the number of years set in the **Math Value** field of the rule. The data set is sorted in descending order by the Created date/time. The lag change operator looks at the first date/time in the set, then looks at the lag value based on the number of years set in the rule. The difference between the latest value and the lag value is returned. In the data set shown below, the value 3.37686333 would be returned if the **Lag Change (Years)** value is set to 1:

15.5154439 - 12.13858057 = 3.37686333	
Created	Actual value
1/31/2022 23:47	15.5154439
12/31/2021 23:45	12.13858057

### Lag Change (Step Back)

First, sorts a data set in descending order by the Created date. Then, it “Steps Back” from the first record in the data set and selects the record based on the number of positions back specified in the **Math Value**. The first record in the data set is position zero. In the data set below, the difference between the 1st record and the 6th record is returned:

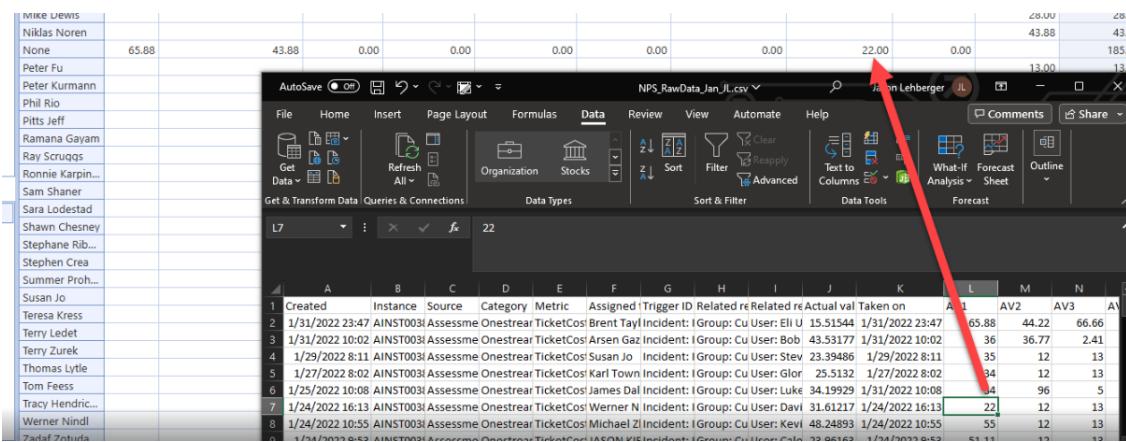
15.5154439 - 6.67 = 8.8454439	
Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12
1/31/2022 22:47	17.77
1/31/2022 21:47	43.53177343
1/30/2022 23:47	101.55
1/29/2022 13:45	23.39486017
1/28/2022 23:47	6.67

## Designing BI Blend

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### Lag (Step Back)

Sorts a data set in descending order by the Created date and “steps back” from the first record in the data set, selecting the record based on the number of positions back specified in the **Math Value**. In the example below, the value of the 6th record (sorted descending) in the data set is returned:



Created	Instance	Source	Category	Metric	Assigned	Trigger ID	Related	Actual val	Taken
1/31/2022 23:47	AINST003	Assessme	Onestrear	TicketCos!	Brent Tay	l Incident: I	Group: Cu	User: Eli U	15.51544
1/31/2022 10:02	AINST003	Assessme	Onestrear	TicketCos!	Arsen Gaz	l Incident: I	Group: Cu	User: Bob	43.53177
1/29/2022 8:11	AINST003	Assessme	Onestrear	TicketCos!	Susan Jo	l Incident: I	Group: Cu	User: Stev	23.39486
1/27/2022 8:02	AINST003	Assessme	Onestrear	TicketCos!	Karl Town	l Incident: I	Group: Cu	User: Glor	25.5132
1/25/2022 10:08	AINST003	Assessme	Onestrear	TicketCos!	James Dal	l Incident: I	Group: Cu	User: Luke	34.19929
1/24/2022 16:13	AINST003	Assessme	Onestrear	TicketCos!	Werner N	l Incident: I	Group: Cu	User: Davi	31.61217
1/24/2022 10:55	AINST003	Assessme	Onestrear	TicketCos!	Michael Z	l Incident: I	Group: Cu	User: Kevi	48.24893
1/24/2022 0:52	AINST003	Assessme	Onestrear	TicketCos!	IA SON VIE	l Incident: I	Group: Cu	User: Gail	39.98162

### Lag Change (Hours)

Returns the difference between the latest value and a past value (lagged value), per the number of hours set in the **Math Value** field. The data set is first sorted in descending order by the Created date/time. The lag change operator looks at the first date/time in the set, then looks at the lag value based on the number of hours. The difference between the latest value and the lag value is returned.

In the data set shown below, the value -28.02 would be returned if the **Lag Change (Hours) Math Value** is set to 2, where  $48.24893 - 21.12 = -28.02$ .

Created	Actual value
1/31/2022 23:47	15.5154439
1/31/2022 23:43	21.12
1/31/2022 22:47	17.77
1/31/2022 21:47	43.53177343

### Absolute Value

Generates a new record that contains the absolute value of the values in the load file.

### Round (Precision)

Generates a new record that contains the rounded value of the values in the load file. The `Math.Round(decimal, int)` method is used. The **Math Value** is the number of decimal places in the return value. It rounds a decimal value to the specified number of decimal places and rounds midpoint values to the nearest even number.

### Modulo (Divisor)

Calculates the modulo (remainder after division) value. For example, 12/10 modulo = 2. The divisor is set in the **Math Value** field within the **Derivative Expression Editor** dialog box. The default divisor value is 10.

### Power (Exponent)

Generates a new record that contains the exponential value of the values in the load file. For example, 5 to the power of 2 is  $5 \times 5 = 25$ . The power value is set in the **Math Value** field of the **Derivative Expression Editor** dialog box.

### Proportion (Count)

Calculates the proportion of 1 out of the total number of rows that were created. For example, in the rule expression **A#[TicketCost]=Stats\_PropCount:A1#[]=None:A2#[]=None:xBDT#[2022-01-01~2022-12-31]!Y**, a derivative record is created for each record where the account = TicketCost and that fall within the date range 2022-01-01 - 2022-12-31. If 54 total rows are created, the proportion count value will equal  $1/54 = 0.018518519$ .

### Proportion (Value)

Calculates the proportion of the value of a field out of the total for that column, where **Value / Sum of column = Proportion (Value)**. For example, in the rule expression **A#[TicketCost]=Stats\_PropValue:A1#[]=None:A2#[]=None:xBDT#[2022-01-01~2022-12-31]!Y**, a derivative record is created for each record where the account = TicketCost, and that falls within the date range 2022-01-01 to 2022-12-31.

### Clip (Lower Bound)

Sets a minimum lower threshold for records that are created as a result of this rule. The default value is 10. Values less than the lower bound are set to the lower bound value. For example, if the original value is 9, the value is set to 10 in the derived record.

### Clip (Upper Bound)

Sets an upper threshold for records that are created as a result of this rule. The default value is 35. Values greater than the upper bound are set to the upper bound value. For example, If the original value is 36, the value is set to 35 in the derived record.

### Count

Creates one record in the BI Blend table. This is a count of the total number of rows returned per the rule expression.

### First DateTime

Creates one record in the BI Blend table that shows the value for the earliest created date/time of the records matching the rule expression.

### Last DateTime

Creates one record in the BI Blend table that shows the value for the latest date/time of the records that match the rule expression.

### Minimum Value

Creates one record in the BI Blend table that shows the lowest value for the records that match the rule expression.

### Maximum Value

Creates one record in the BI Blend table that shows the highest value for the records that match the rule expression.

### Average

Creates one record in the BI Blend table that shows the average value for the records that match the rule expression.

### Median

Creates one record in the BI Blend table that shows the median value for the records that match the rule expression.

### Mode

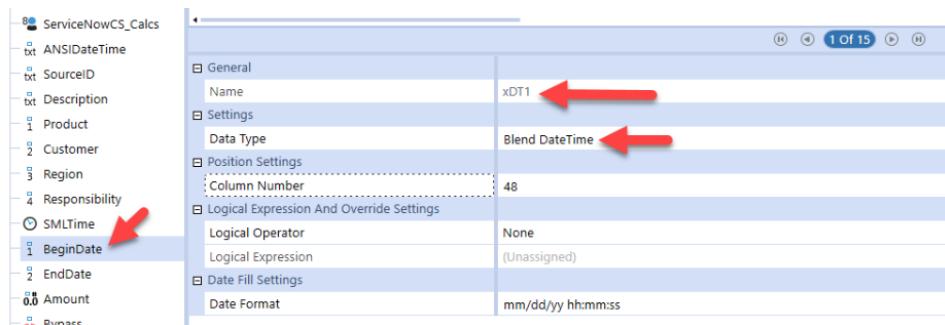
Creates one record in the BI Blend table that shows the mode value for the records that match the rule expression. The mode is the value that appears the most number of times in a data set. If there are multiple instances of a mode in a file, the first value is returned if the values are sorted ascending. This is also done for the mode calculation in Excel.

### Standard Deviation

Creates one record in the BI Blend table that shows the standard deviation value for the records that match the rule expression. It uses the standard deviation based on the entire population. Numbers can be validated by using the STDEV.P function in Excel.

### Col DateDiff (Days)

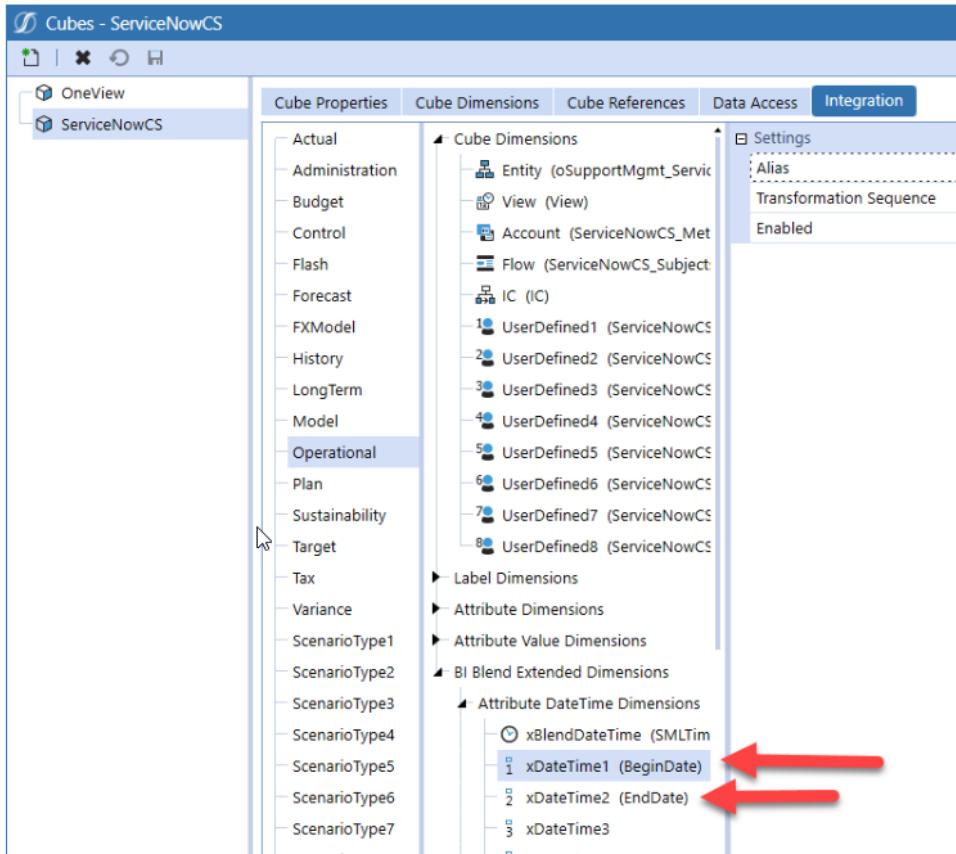
Returns the number of days within the BeginDate and EndDate specified in the load file. The value is rounded down to the nearest whole number. The **Math Value** syntax,  $/x\text{Dt1};x\text{Dt2}$ , indicates that the difference between EndDate and BeginDate is returned. **XDt1** and **XDt2** are aliases for BeginDate and EndDate, which are set in the Data Source:



BI Blend DateTime dimensions are set on the cube:

## Designing BI Blend

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Here is an example of a rule expression for this operator: **A#[TicketCost]=Stats\_DateDiffDays1and2:A1#[]=None:A2#[]=None:xBDT#[2022-01-01 00:00:00~2022-12-31 23:59:59]!D**. This filters the data series to return account data between the specified date range, and sets the Group Level by day.

For all accounts named TicketCost in the load file, create a new record and do the following:

1. **DateDiffDays.E**: the **.E** portion of this rule name sets the Account Type to **Expense**.
2. Change account name to **Stats\_DateDiffDays1and2**.
3. Set all A1 instances (Product column in db, Instance column from load file) to **None**.
4. Set all A2 instances (Customer column in db, Instance col from load file) to **None**.

### Col DateDiff (Months)

Returns the number of months within the BeginDate and EndDate specified in a load file. The value is rounded down to the nearest whole number. The **Math Value** syntax, `//xDt1;xDt2`, indicates that the difference between EndDate and BeginDate is returned. **xDt1** and **xDt2** are aliases for BeginDate and EndDate, which are set in the Data Source (see Col DateDiff (Days)).

Here is an example of a rule expression for this operator: `A#[TicketCost]=Stats_DateDiffMonths:A1#[]=None:A2#[]=None:xBDT#[2022-01-01 00:00:00~2022-12-31 23:59:59]!M`. `:xBDT#[2022-01-01 00:00:00~2022-12-31 23:59:59]` filters the data series to return account data in the date range specified. `!M` sets the Group Level by Month.

### Col DateDiff (Years)

Returns the number of years within the BeginDate and EndDate specified in a load file. The value is rounded down to the nearest whole number. The **Math Value** syntax, `//xDt1;xDt2`, indicates that the difference between EndDate and BeginDate is returned. **xDt1** and **xDt2** are aliases for BeginDate and EndDate, which are set in the Data Source.

### Col DateDiff (Hours)

Returns the number of hours within the BeginDate and EndDate specified in a load file. The value is rounded down to the nearest whole number hour. The **Math Value** syntax, `//xDt1;xDt2`, indicates that the difference between EndDate and BeginDate is returned. **xDt1** and **xDt2** are aliases for BeginDate and EndDate, which are set in the Data Source:

### Col DateDiff (Minutes)

Returns the number of minutes within the BeginDate and EndDate specified in a load file. The value is rounded down to the nearest whole number minute. **xDt1** and **xDt2** are aliases for BeginDate and EndDate, which are set in the Data Source:

### Col DateDiff (Seconds)

Returns the number of seconds within the BeginDate and EndDate specified in a load file. **xDt1** and **xDt2** are aliases for BeginDate and EndDate, which are set in the Data Source:

### Log (P+1)

Generates a new record that contains the natural log (1+x) value of the values in the load file. The following function is used in the calculation: **Math.Log() function. Natural Log (1+x)**.

**NOTE:** The formula reference in BI Blend for the Log P1 function is not calculated for values  $\leq 1$  and returns null in that case.

### Apply Suffix or Prefix

Renames accounts to either **MyPrefix\_TicketCost** or **TicketCost\_MySuffix** using the following expressions: **A#[TicketCost]>>MyPrefix\_** or **A#[TicketCost]<<\_MySuffix**, respectively.

### Create If (> x)

Creates a record in the BI Blend table for each record where the Actual Value is greater than the value set in **Math Value**.

### Create If (< x)

Creates a record in the BI Blend table for each record where the Actual Value is less than the value set in **Math Value**.

## Filtering Records with Rule Expressions

Rule expressions in transformation rules can be used to filter records by date and time ranges using xBDT syntax. When data is loaded, derivative records are created for records that fall within the specified date and time range. Here are some examples:

**xBDT#[2022-01-01 00:00:00~2022-01-31 23:59:59]**: Creates derivative records for imported records that are  $\geq$  start date/time and  $\leq$  finish date/time.

**xBDT#[CurrentDateTimeLocal~D+6]**: Creates derivative records for imported records that are greater than the current date/time plus 6 days.

**xBDT#[D-90~2022-03-31 23:59:59]**: Creates derivative records for imported records that fall within the range of the specified date/time minus 90 days. Records equal to the current date/time are imported as well.

## Sub-String Grouping in Rule Expressions

Syntax used in a rule expression can capture a specified number of characters from a string, starting with the character in the first position. In the example below, the first 6 characters of an account name are captured and applied in derivative records. Loaded records with an account name **TicketCost** will show an account name of **Ticket** in the derived records.

### **A#[TicketCost]@6**

Syntax used in a rule expression can capture a sub-string between the first and last characters of a string. In the example below, a 4 character sub-string is captured starting at the 7th character of the string. Loaded records with an account name **TicketCost** will show an account name of **Cost** in the derived records.

### **A#[TicketCost]@7,4**

# Logical Operators Usage

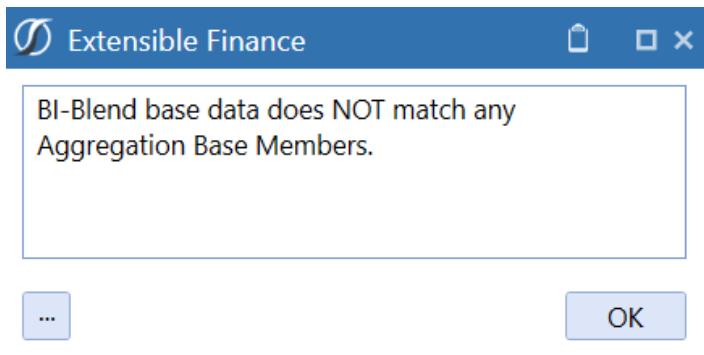
Logical Operators extend a normal mapping rule with VB.Net scripting functionality. To use logical operators:

1. Navigate to **Application** tab > **Data Collection** > **Transformation Rules**.
2. Under **Rule Groups**, expand **Derivative**, then select a derivative rule group.
3. Select a value from the **Type** drop-down menu.
4. Click **Insert Row**.
5. Type a name into the **Rule Name** field.
6. Type a description into the **Description** field.
7. Type an expression into the **Rule Expression** field. For example, **A#[TicketCost]=Math\_Power2:A1#[]=None:A2#[]=None:xBDT#[2022-01-01 00:00:00~2022-12-31 23:59:59]!Y**
8. Double-click the new row in the **Logical Operator** column.
9. In the **Derivative Expression Editor** dialog, from the **Expression Type** drop-down menu, select the logical operator you would like to use.
10. Type an appropriate value into the **Math Value** field and click **OK**.
11. In the **Derivative Type** column, set the value to **Final (Exclude Calc)**.
12. In the **Order** column, type a value that is greater than the current highest order value in the list.
13. Click **Save**.
14. Navigate to the **OnePlace** tab and set a BI Blend Workflow POV.
15. Click **Load and Transform**.
16. Select a file and click **Open**.
17. Click **OK**.

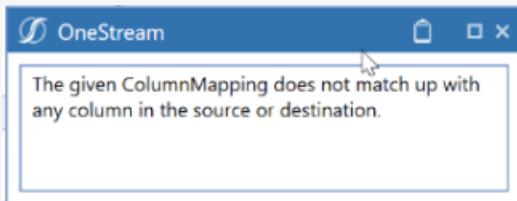
18. Log in to the database server for the environment and execute a query on the BI Blend database where the data was loaded to. You will see records returned.
19. Verify that the values in the applicable amount column are equal to the expected results.

# Common Error Messaging

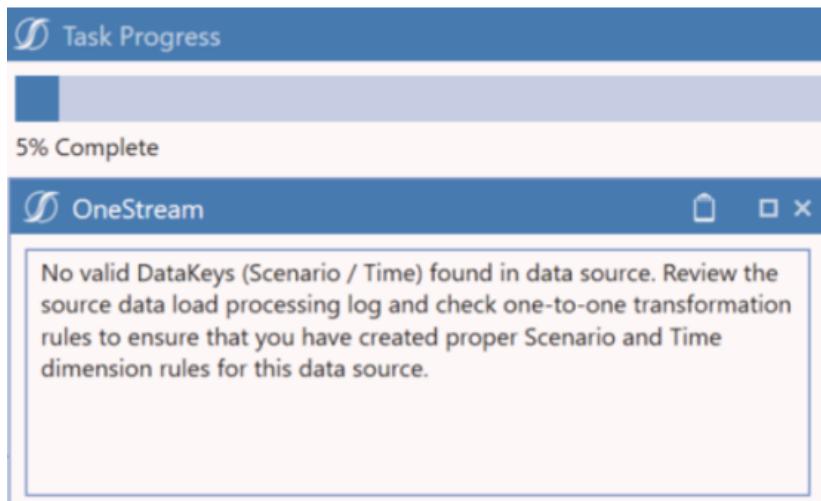
Cannot find a matching base member in the data record, no data intersections are found.



**NOTE:** A BI Blend data source cannot be used to import data to Stage because the extra BI Blend attributes and date dimensions do not work for Stage. The following error message is one example of the messages you might see.



You will see the following error message when loading to a workflow if attribute value dimensions have been assigned a static value.



# Reporting Components

## Dashboard Adapter – BIBlendInfo Method Query

BIBlendInfo Method Query is available to retrieve the relative information from the StageBIBlendInformation Table.

The image shows a configuration interface for the BIBlendInfo Method Query. It has two main sections: 'General (Data Adapter)' and 'Data Source'.

General (Data Adapter)	
Name	
Description	
Maintenance Unit	GolfStream Parameters

Data Source	
Command Type	Method
Method Type	BiBlendInfo
Method Query	(Select One)
Results Table Name	BiBlendInfo <input type="button" value=""/>

The 'Method Query' dropdown is open, showing options: BiBlendInfo (selected), BusinessRule, and CertificationForWorkflowUnit. The 'Results Table Name' field is also visible.

# Large Pivot Grid

The Large Pivot Grid is a Dashboard Component which is designed to allow pivot style dashboard reporting and analysis on external database tables. Key features of this Component are:

- Server based processing – Key solution for accessing data in large tables. Pivoting requests are performed on the server, returning only the requested “slice” of data.
- Supports paging to manage large data sets
- Measures support only a single aggregation type, (Sum, Min, Max)

Component Properties	
General (Component)	
Name	BIBLargePivGrid_Att
Description	
Maintenance Unit	BIBlend
Component Type	Large Data Pivot Grid (Windows App Only)
Large Data Pivot Grid	
Show Toggle Size Button	True
Database Location	External
External Database Connection	BIBlendReporting
Table Name	BIB_{AppName}_{WFText1}_{WFScenario}_{WFTime}
Row Fields	Account
Column Fields	Entity
Data Fields	WFTime
Data Field Aggregation Types	
Excluded Fields	Flow,Origin,IC,UD1,View,SourceID,TextValue,Rt,Label,Cons,Scenario,Account Type,UD5
Page Size	500

# BI Blend Data Adapter

The BI Blend Adapter is used to simplify writing queries to the BI Blend tables by eliminating the need for SQL scripting. As an Adapter, it cannot support the complete contents of very large BI Blend tables. The BI Blend Adapter should contain “where” clauses to slice the results into reporting slices. The BI Blend Adapter does not support paging to manage large volumes of records.

General (Data Adapter)	
Name	BIBlend_DataAdapter
Description	BI Blend Adapter
Maintenance Unit	BIBlend
Data Source	
Command Type	BI-Blend
Results Table Name	BIBLEND1
Table Info	BIB_{AppName}_{WFText1}_{WFSenario}_{WFTime}
Group By	Entity,HoustonProducts,HoustonCustomers
Data Field Aggregation Types	AggType1 = [2018M1, Sum],AggType2 = [2018M1, Count]
Where Clause	HoustonCustomers = 'shanks'

## Fdx Specialty Connector BRAPI's

FDX, Fast Data Extract, BRAPIs allow a variety of options for connecting to DataSources for BI Blend. A key differentiator between the FDX BRAPI's and other collection methods is support of parallel processing, in memory processing and management of the Time dimension.

FDX BRAPI's provide functionality to build Connectors to extract data from:

- **Cube Views:** Extract data through a Cube View definition. Ideal for defining data definitions through a Cube View, including Dynamic Calc results.
- **Across Cube Data Units:** Extract Cube data to a BI Blend target table through defined Data Unit filters.
- **Stage Workflow Imports:** Ability to leverage existing Stage Data. Uses may be reporting on existing "attribute" records contained in Stage, or simply enhanced dashboard reporting on Stage data.
- **Source Systems / Data Warehouses:** Performance oriented solution to connect to source system.

Performance is gained through the BRAPI's ability to parallel process. For example, extracting data by Cube Data Unit will parallel process all the Data Units defined in the filter. Second, the FDX BRAPI's do not generate a ".CSV" file as do Data Management File "Export Data" or "Export File" processes. The results of the export are managed during the BI Blend "in-memory" processing.

In cases of very large data sets, which where multiple periods are loaded, the processing time can be slow because each period is reflected as a data record. FDX BRAPI's offer solutions to pivot the Time records to columns in order to create a matrix data layout. The Datasource can associate each of the periods with an “Attribute Value” field within the Integration settings. The design will treat each record as a collection of 12 periods when processing.

- **FdxExecuteCubeView:** Extract data defined through a Cube View. Any data presented in the Cube View will be extracted, such as Dynamic Calculated results.
- **FdxExecuteCubeViewTimePivot:** Cube View Data will generate all time as Columns which can be assigned as Attribute Value members in the Data Source.
- **FdxExecuteDataUnit:** Cube Data extract solution to extract data from Data Unit members.
- **FdxExecuteDataUnitTimePivot:** Cube Data extract solution to extract data from Data Unit members. Generate all time as Columns, which can be assigned as Attribute Value members in the Data Source.
- **FdxExecuteStageTargetTimePivot:** Extract existing Workflow's Stage Data. Generate all time as Columns, which can be assigned as Attribute Value members in the Data Source.
- **FdxExecuteWarehouseTimePivot:** Extract data from an external source system.
- **FdxGetCubeViewOrDataUnitColumnList:** Connector BRAPI used to return field names.
- **FdxGetStageTargetColumnList:** Connector BRAPI used to return field names.
- **FdxGetWarehouseColumnList:** Connector BRAPI used to return field names.

## Using Fdx Connectors

Workflow Connectors are required to realize the benefits of the parallel processing and Time Pivot capabilities of the FDX BRAPI's. Once created, the Connectors are assigned to the BI Blend Workflow. Each type of Connector is defined using “name value pairs” on the properties of the Workflow Text fields.

## Common Error Messaging

---

```
Public Function Main(ByVal si As SessionInfo, ByVal globals As BRGlobals, ByVal api As Transformer, ByVal args As ConnectorArgs) As Object
    Try
        Select Case args.ActionType
            Case Is = ConnectorActionTypes.GetFieldList
                Return FieldNameList
            Case Is = ConnectorActionTypes.GetTimePivot
                Dim timePivot As String = "T#2018.Base"
                Dim isTimePivot As Boolean = True
                Dim useGenericTimeColumn As Boolean = True
                Return BRApi.Import.Data.FdxGetCubeViewOrDataUnitColumnList(si, timeMemFilter, isTimePivot, useGenericTimeColumn)
            Case Is = ConnectorActionTypes.GetParams
                'Parameter Format for WorkflowProfile Text4
                'EntityMF=[E#Total.GolfStream].Base],ConName=[Local],ScenarioType=Name=[Actual],ScenarioMF=[#Actual],TimeMF=[T#2017.Base],ViewName=[YTD],SuppressNoData=[0],Filter=[Account Like '1' or Account Like '2' or Account Like '3' or Account Like '4' or Acc
                'Get Parameters Stored in Text4
                Dim nvb As New NameValueCollection(api.workflowProfile.GetAttributeValue(api.ScenarioTypeID, SharedConstants.WorkflowProfileAttributeIndexes.Text4))
                Dim cubeName As String = api.CubeName
                Dim entityMemFilter As String = nvb.NameValuePairs.XFGetValue("Entity", String.Empty)
                Dim scenarioName As String = nvb.NameValuePairs.XFGetValue("ScenarioName", String.Empty)
                Dim consume As String = nvb.NameValuePairs.XFGetValue("Consume", String.Empty)
                Dim scenarioType As String = nvb.NameValuePairs.XFGetValue("ScenarioType", ScenarioType.Actual.Name)
                Dim scenarioTypeAsInteger As Integer = ScenarioType.Actual.ID
                Dim timeMemFilter As String = nvb.NameValuePairs.XFGetValue("Time", String.Empty)
                Dim viewName As String = nvb.NameValuePairs.XFGetValue("View", String.Empty)
                Dim suppressNoData As Boolean = Boolean.TryParse(nvb.NameValuePairs.XFGetValue("SuppressNoData", "1"))
                Dim useGenericTimeColumn As Boolean = True
                Dim filter As String = nvb.NameValuePairs.XFGetValue("Filter", String.Empty)
                Dim parallelQueryCount As Integer = 8
                Dim logStatistics As Boolean = False
                'Process Data
                Dim dt As DataTable = BRApi.Import.Data.FdxExecuteDataUnitTimePivot(si, cubeName, entityMemFilter, consume, scenarioName, scenarioType, scenarioMemFilter, timeMemFilter, viewName, suppressNoData, useGenericTimeColumn, filter, parallelQueryCount, logStatistics)
                If Not dt Is Nothing Then
                    api.Parser.ProcessDataTable(si, dt, True, api.ProcessInfo)
                Else
                    BRApi.ErrorLog.LogError(si, "FDX DU Params", nvb.GetFormatString())
                End If
            Return Nothing
        End Select
    End Try

```

BI-Blend Parameters
Substitution Text Settings
Text 1
Text 2
Text 3
Text 4
CubeViewName=[FDX_TrendTrailingSales],EntityDimName=[CorpEntities],EntityMF=[E#Total.GolfStream].Base],

## Server Roles

### Optional Application Server

The default processing will be BI Blend processed are queued across the available Stage Servers. Within the Workflow BI Blend Settings, a defined server can be established for all BI Blend processes. This can be as a list and support wild cards.

## Batch Processing Support

Batch Processing is supported through automating the BI Blend process.