Sam's Club
Data and SAP BI Infrastructure

Lorraine R. Gardiner, PhD.
lgardiner@csuchico.edu
Professor, Department of Accounting and MIS
California State University, Chico
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Faculty Summary

The SAP BI infrastructure to support class exercises using Sam's Club data includes two InfoCubes, one with general store visits data and another with product-related line item details. The InfoCubes are loaded with data extracted from a database on the University of Arkansas Teradata server containing approximately 2.6 million visits with 15.3 million associated line items. For performance and exercise scope purposes, the data loaded into the SAP BI InfoCubes were restricted to 11 of the 72 item categories represented in the line items details[1]. The resulting store visit and line item InfoCubes contain 1.4 and 3.1 million records, respectively.

Using these InfoCubes, Dr. Jim Mensching has created an extensive set of curriculum content emphasizing returns fraud investigation and control. His materials include assignments, solutions and "how to" videos. The data in the InfoCubes is, however, rich enough to support faculty in designing additional cases or exercises with emphases besides returns fraud (e.g., margin analysis).

Teradata Source Data

The University of Arkansas Enterprise Systems Teradata source (UA_SAMSCLUB_SMALL) contains store visit information of seven stores from 7/31/2005 through 11/03/2006. The ERD and metadata are provided in Figure 1 and Table 1 below, based on a similar dataset (UA_SAMSCLUB).

Figure 1: ERD (Source: http://enterprise.waltoncollege.uark.edu/1682.asp)

[1] Approximately 2.2 million of the line items are not associated with an item category.

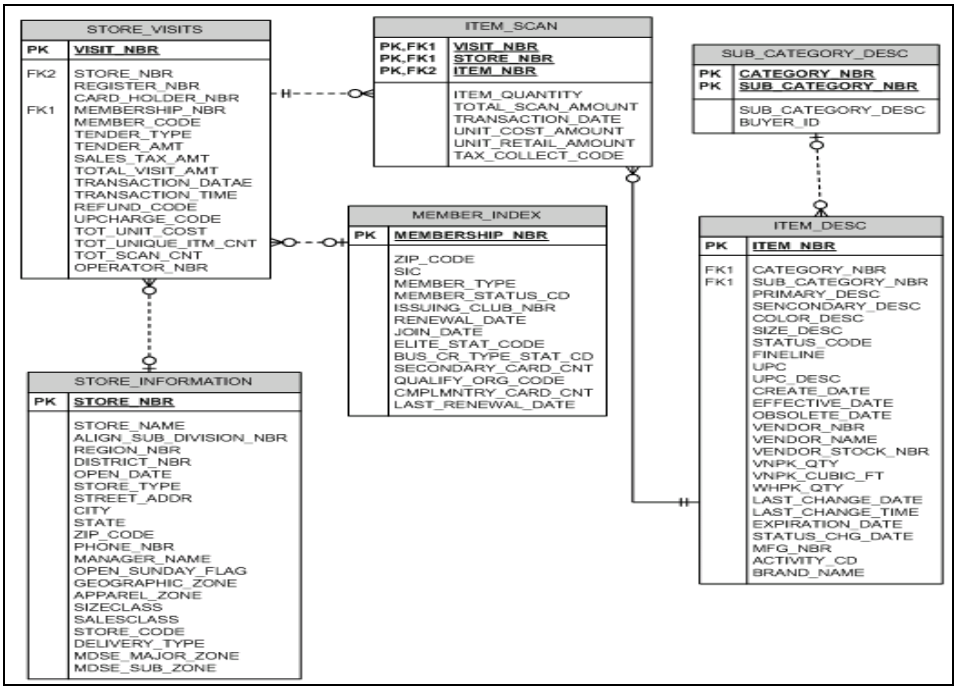

STORE_VISITS
PK VISIT_NBR
FK2 STORE_NBR
REGISTER_NBR
CARD_HOLDER_NBR
FK1 MEMBERSHIP_NBR
MEMBER_CODE
TENDER_TYPE
TENDER_AMT
SALES_TAX_AMT
TOTAL_VISIT_AMT
TRANSACTION_DATAE
TRANSACTION_TIME
REFUND_CODE
UPCHARGE_CODE
TOT_UNIT_COST
TOT_UNIQUE_ITM_CNT
TOT_SCAN_CNT
OPERATOR_NBR
ITEM_SCAN
PK,FK1 VISIT_NBR
PK,FK1 STORE_NBR
PK,FK2 ITEM_NBR
ITEM_QUANTITY
TOTAL_SCAN_AMOUNT
TRANSACTION_DATE
UNIT_COST_AMOUNT
UNIT_RETAIL_AMOUNT
TAX_COLLECT_CODE
SUB_CATEGORY_DESC
PK CATEGORY_NBR
PK SUB_CATEGORY_NBR
SUB_CATEGORY_DESC
BUYER_ID
MEMBER_INDEX
PK MEMBERSHIP_NBR
ZIP_CODE
SIC
MEMBER_TYPE
MEMBER_STATUS_CD
ISSUING_CLUB_NBR
RENEWAL_DATE
JOIN_DATE
ELITE_STAT_CODE
BUS_CR_TYPE_STAT_CD
SECONDARY_CARD_CNT
QUALIFY_ORG_CODE
CMPLMNTRY_CARD_CNT
LAST_RENEWAL_DATE
ITEM_DESC
PK ITEM_NBR
FK1 CATEGORY_NBR
FK1 SUB_CATEGORY_NBR
PRIMARY_DESC
SENCONDARY_DESC
COLOR_DESC
SIZE_DESC
STATUS_CODE
FINELINE
UPC
UPC_DESC
CREATE_DATE
EFFECTIVE_DATE
OBSOLETE_DATE
VENDOR_NBR
VENDOR_NAME
VENDOR_STOCK_NBR
VNPK_QTY
VNPK_CUBIC_FT
WHPK_QTY
LAST_CHANGE_DATE
LAST_CHANGE_TIME
EXPIRATION_DATE
STATUS_CHG_DATE
MFG_NBR
ACTIVITY_CD
BRAND_NAME
STORE_INFORMATION
PK STORE_NBR
STORE_NAME
ALIGN_SUB_DIVISION_NBR
REGION_NBR
DISTRICT_NBR
OPEN_DATE
STORE_TYPE
STREET_ADDR
CITY
STATE
ZIP_CODE
PHONE_NBR
MANAGER_NAME
OPEN_SUNDAY_FLAG
GEOGRAPHIC_ZONE
APPAREL_ZONE
SIZECLASS
SALESCLASS
STORE_CODE
DELIVERY_TYPE
MDSE_MAJOR_ZONE
MDSE_SUB_ZONE

Table 1: Metadata (Source: http://enterprise.waltoncollege.uark.edu/1682.asp)

Attribute	Description	Values
ACTIVITY_CD	Activity Code	Y, N
BRAND_NAME	Name of the brand associated with the item	Null, name of brand
BUS_CR_TYP_STAT_CD	Business Credit Type Status Code	0-10
CARD_HOLDER_NBR	Card holder within an account	1-99
CATEGORY_NBR	Number assigned to a category of items	Null, 0-99
CMPLMNTRY_CARD_CNT	Number of extra cards given to an account	0-4
COLOR_DESC	Color description of an item	White, Almond, etc
CREATE_DATE	Date the item was created	Date
EFFECTIVE_DATE	Date the item began to be sold	Date
ELITE_STAT_CODE		0-4
EXPIRATION_DATE	Expiration date of an item	Date
FINELINE	Combination of category_nbr & sub_category_nbr	4 digit number
ISSUING_CLUB_NBR	The club that the member originally joined	1-150
ITEM_NBR	The number assigned to every different item for sale	Unique number (PK)
ITEM_QUANTITY	The quantity of a unique item that is scanned	
JOIN_DATE	Date the member joined the club	Date
LAST_RENEWAL_DATE	Last date that the member renewed their membership	Date
MEMBER_CODE		1,A,D,E,G,V,W,X,Y
MEMBER_STATUS_CD		A,D,E,T
MEMBER_TYPE		1,A,E,G,V,W,X
MEMBERSHIP_NBR	The number assigned to the member upon joining the club	
MFG_NBR	Number representing a manufacturer	
OBSOLETE_DATE	The date an item is no longer sold	Date
OPERATOR_NBR		
PRIMARY_DESC	The description of an item	Teal X-Large etc
QUALIFY_ORG_CODE		Null, 015-3001
REFUND_CODE	Code to indicate a return transaction	0 = Not Return, 1= Return
REGISTER_NBR	The register identification number where the transaction took place	1-85
RENEWAL_DATE	Date a membership should be renewed	Date
SALES_TAX_AMT	Tax charged for total visit	
SECONDARY_CARD_CNT	Number of cards other than primary card assigned to the membership	
SECONDARY_DESC	Additional description of an item	Sweatshirt, gift set etc
SIC	Standard Industry Classification code	783700, 443700 etc
SIZE_DESC	Text description of the size of the item, including clothing and non-clothing items	15CUFT, LARGE, etc
STATUS_CHG_DATE	The date an item last changed its status code	Date
STATUS_CODE	Whether an item is active or deactive	A = Active, D = Deactive
STORE_NAME	The name of the store	
STORE_NBR	Store identification number	1-150
SUB_CATEGORY_NBR	The number assigned to a sub_category of items	
TAX_COLLECT_CODE	Purchase taxable or not	0,1
TENDER_AMT	The amount tendered for the purchase	
TENDER_TYPE	Type of payment used	0 - Cash 1 - Check 2 - Gift Card 3 - Discover 4 - Direct Credit 5 - Business Credit 6 - Personal Credit
TOT_SCAN_CNT	Total number of scanned items per transaction	
TOT_UNIQUE_ITM_CNT	The number of unique items purchased per transaction	0-84
TOT_UNIT_COST	The cost of the item (scrubbed)	
TOTAL_SCAN_AMOUNT	The total number of items scanned per visit number	
TOTAL_VISIT_AMT	The total value of the entire transaction	
TRANSACTION_DATE	Date of the transaction	
TRANSACTION_TIME	The time of day that the transaction started	
UNIT_COST_AMOUNT	Cost/Unit (scrubbed)	
UNIT_RETAIL_AMOUNT	Purchase Price/Unit (scrubbed)	
VENDOR_NBR	The number of the vendor that supplies the item	
VISIT_NBR	Every time a member goes to the register and has their membership card scanned, this number is then created	9 digit #
VNPK_CUBIC_FT	How many cubic feet does a vendor pack take up	
VNPK_QTY	The quantity of items in a vendor pack	
ZIP_CODE	The zip-code of the store	
ZIP_CODE	The zip-code of the member	

The data scrubbing referenced in the metadata makes it impossible to reconcile some attributes between the Store_Visits and Item_Scan tables. A sample visit (#355486057) made at Store 6 on May 1, 2006 and its associated Store_Visits and Item_Scan data illustrates the problem. The visit contains four unique item numbers (Tot_Unique_Itm_Cnt=4) with a total of eight items scanned (Tot_Scan_Cnt=8). The total unit cost and visit amounts in the Store_Visits table are $42 and $49, respectively. Table 2 contains the Item_Scan data for this visit. Note how the data scrubbing has removed the relationship between the cost, scan and retail totals in the two tables.

Table 2: Item_Scan Data for Visit #355486057

Item_Nbr	Item_Quantity	Total_Scan_Amount	Unit_Cost_Amount	Unit_Retail_Amount	Total Cost	Total Retail
147588	3	$35.97	$20.94	$21.99	$62.82	$65.97
148320	1	$19.29	$18.80	$19.29	$18.80	$19.29
165550	1	$19.99	$19.16	$19.99	$19.16	$19.99
884993	3	$18.75	$16.14	$16.25	$48.42	$48.75
Visit Totals:		**$94.00**			**$149.20**	**$154.00**

The UA_SAMSCLUB_SMALL dataset does not contain data from all stores over the entire time period. Table 3 below summarizes the distribution of visits by store and fiscal year quarter.

Table 3: Store Visit Distribution

		Store Number						
Fiscal Year/Qtr	Start Date	6	7	8	10	59	66	68
6/2	**5/1/2005**					1,736	1,310	
6/3	**8/1/2005**					94,925	71,831	
6/4	**11/1/2005**	10,404				117,272	86,804	
7/1	**2/1/2006**	149,708		91,915		99,143	70,472	6,403
7/2	**5/1/2006**	161,603	87,613	188,844	2,672	106,724	73,829	243,124
7/3	**8/1/2006**	156,186	146,400	194,592	16,530	98,999	72,316	253,559
7/4	**11/1/2006**	3,015	2,792	3,976	907	2,125	1,488	5,563

InfoObject Definitions

The Sam's Club characteristics and key figure definitions, including source data fields, are provided in Tables 4-9. Note that transaction dates are mapped to calendar days, quarters and years versus the Sam's Club fiscal year definitions.

Table 4: ITEM_SCAN Key Figure Definitions

Source Field	InfoObject Description	InfoObject Name	Comments
ITEM_QUANTITY	Purchase Item Quantity	SCSPQ	ITEM_QUANTITY for purchases
ITEM_QUANTITY	Return Item Quantity	SCSRQ	ITEM_QUANTITY for returns
UNIT_COST_AMOUNT	Unit Cost Amount	SCSCS	
UNIT_RETAIL_AMOUNT	Unit Retail Amount	SCSURC	
	Purchase Item Total Cost	SCSTCA	ITEM_QUANTITY*UNIT_COST_AMOUNT for purchases
	Purchase Item Total Retail	SCSTSA	ITEM_QUANTITY*UNIT_RETAIL_AMOUNT for purchases
	Return Item Total Cost	SCSTRCA	ITEM_QUANTITY*UNIT_COST_AMOUNT for returns
	Return Item Total Retail	SCSTRA	ITEM_QUANTITY*UNIT_RETAIL_AMOUNT for returns

Table 5: STORE_VISITS Key Figure Definitions

Source Field	InfoObject Description	InfoObject Name	Comments
SALES_TAX_AMT	Purchase Sales Tax Amount	SCSSTA	SALES_TAX_AMT for purchases
SALES_TAX_AMT	Returns Sales Tax Amount	SCSRSTA	SALES_TAX_AMT for returns
TENDER_AMT	Purchase Tender Amount	SCSTT	TENDER_AMT for purchases
TENDER_AMT	Return Tender Amount	SCSRTA	TENDER_AMT for returns
TOT_SCAN_CNT	Purchase Total Scan Count	SCSTSC	TOT_SCAN_CNT for purchases
TOT_SCAN_CNT	Return Total Scan Count	SCSTRSC	TOT_SCAN_CNT for returns
TOT_UNIQUE_ITM_CNT	Purchase Unique Item Count	SCSUIC	TOT_UNIQUE_ITM_CNT for purchases
TOT_UNIQUE_ITM_CNT	Return Unique Item Count	SCSRUIC	TOT_UNIQUE_ITM_CNT for returns
TOT_UNIT_COST	Purchase Total Unit Cost	SCSTUC	TOT_UNIT_COST for purchases
TOT_UNIT_COST	Return Total Unit Cost	SCSRTUC	TOT_UNIT_COST for returns
TOTAL_VISIT_AMT	Purchase Total Visit Amount	SCSTS	TOTAL_VISIT_AMT for purchases
TOTAL_VISIT_AMT	Return Total Visit Amount	SCSRTS	TOTAL_VISIT_AMT for returns

Table 6: ITEM_DESC Characteristic Definitions

Source Field	InfoObject Description	InfoObject Name
BRAND_NAME	Item Brand Name	SCSBNT4
BUYER_ID	Item Buyer ID	SCSBID
CATEGORY_NBR	Item Category Number	SCSCN
COLOR_DESC	Item Color	SCSCLR
CREATE_DATE	Item Create Date	SCSCD
EFFECTIVE_DATE	Item Effective Date	SCSED
ITEM_NBR	Item Number	SCSMA
MFG_NBR	Item Manufacturer Number	SCSMF
SIZE_DESC	Item Size	SCSSZ
SUB_CATEGORY_NBR	Item Sub Category Number	SCSSCT4
UPC	Item UPC	SCSUPS
VENDOR_NBR	Item Vendor Number	SCSVE

Table 7: MEMBER_INDEX Characteristic Definitions

Source Field	InfoObject Description	InfoObject Name
ELITE_STAT_CODE	Member Elite Status Code	SCSESC
ISSUING_CLUB_NBR	Member Issuing Club Number	SCSIC
JOIN_DATE	Member Join Data	SCSJD
LAST_RENEWAL_DATE	Member Renewal Date	SCSRD
MEMBER_STATUS_CD	Member Status Code	SCSMSC
MEMBER_TYPE	Member Type	SCSMT
MEMBERSHIP_NBR	Membership Number	SCSME
ZIP_CODE	Member Postal Code	SCSPC

Table 8: STORE_INFORMATION Characteristic Definitions

Source Field	InfoObject Description	InfoObject Name
CITY	Store Info Store City	SCSCTY
DISTRICT_NBR	Store Info Store District	SCSDN
GEOGRAPHIC_ZONE	Store Info Geographic Zone	SCSGZ
MANGER_NAME	Store Info Store Manager	SCSMG
OPEN_DATE	Store Info Open Date	SCSOD
OPEN_SUNDAY_FLAG	Store Info Open Sunday	SCSOS
REGION_NBR	Store Info Store Region	SCSRE
STATE	Store Info Store State	SCSST
STORE_NBR	Store	SCSRL
ZIP_CODE	Store Info Store Zip Code	SCSZC

Table 9: STORE_VISITS Characteristic Definitions

Source Field	InfoObject Description	InfoObject Name
CARD_HOLDER_NBR	Store Visits Card Holder Number	SCSCHN
MEMBER_CODE	Store Visits Member Code	SCSMC
OPERATOR_NBR	Store Visits Operator Number	SCSON
REFUND_CODE	Store Visits Return or Sale	SCSRC
REGISTER_NBR	Store Visits Register Number	SCSRN
TAX_COLLECT_CODE	Store Visits Tax Collect Code	SCSITC
TENDER_TYPE	Store Visits Payment Type	SCSMP
TRANSACTION_DATE	Calendar Day	0CALDAY
VISIT_NBR	Visit Number	SCSVN

InfoCubes

The data extracted from UA_SAMSCLUB_SMALL includes all stores and dates but is restricted to the 11 item categories shown in Table 10. My teammate on the Sam's Club project, Dr. Jim Mensching, created the category descriptions based on the associated subcategory descriptions.

Table 10: Item Categories

Item Category Number	Item Category Description
2	PERSONAL CARE
3	SCHOOL SUPPLIES
6	ELECTRONIC COMMUNICATION
24	FLOWERS
40	NON-ALCOHOLIC DRINKS
42	FOOD PRODUCTS
48	WHEAT AND CORN PRODUCTS
49	SPICES
52	SODAS
79	FOOD SERVICE ITEMS
87	SPECIAL ORDER - VISION WEAR

Both InfoCubes are highly detailed, including data at the transaction level to facilitate drilldowns in student exercises. The store visits and line item InfoCube structures are provided in Figures 2 and 3 below. The characteristic and navigational short names appear in the star schema, BEX Analyzer and Query Designer rather than the longer InfoObject descriptions in Tables 4-9 above.

The Store Visits InfoCube (SCSC2) includes member, store, time, and visit dimensions for analysis of key figures based on the Sam's Club STORE_VISITS Teradata table attributes. Each dimension includes the base characteristic (e.g., Membership Number) plus its navigational attributes (e.g., Membership Type). It is important to note that the store visit key figures cannot be analyzed by item since they are pre-rolled across all items for each visit in the STORE_VISITS table. As the name suggests, the Line Item InfoCube (SCSC3) includes an item dimension in addition to member, store, time and visit dimensions to facilitate analysis of key figures derived from measures in the Teradata ITEM_SCAN table.

Figure 2: Store Visits InfoCube (SCSC2) Star Schema

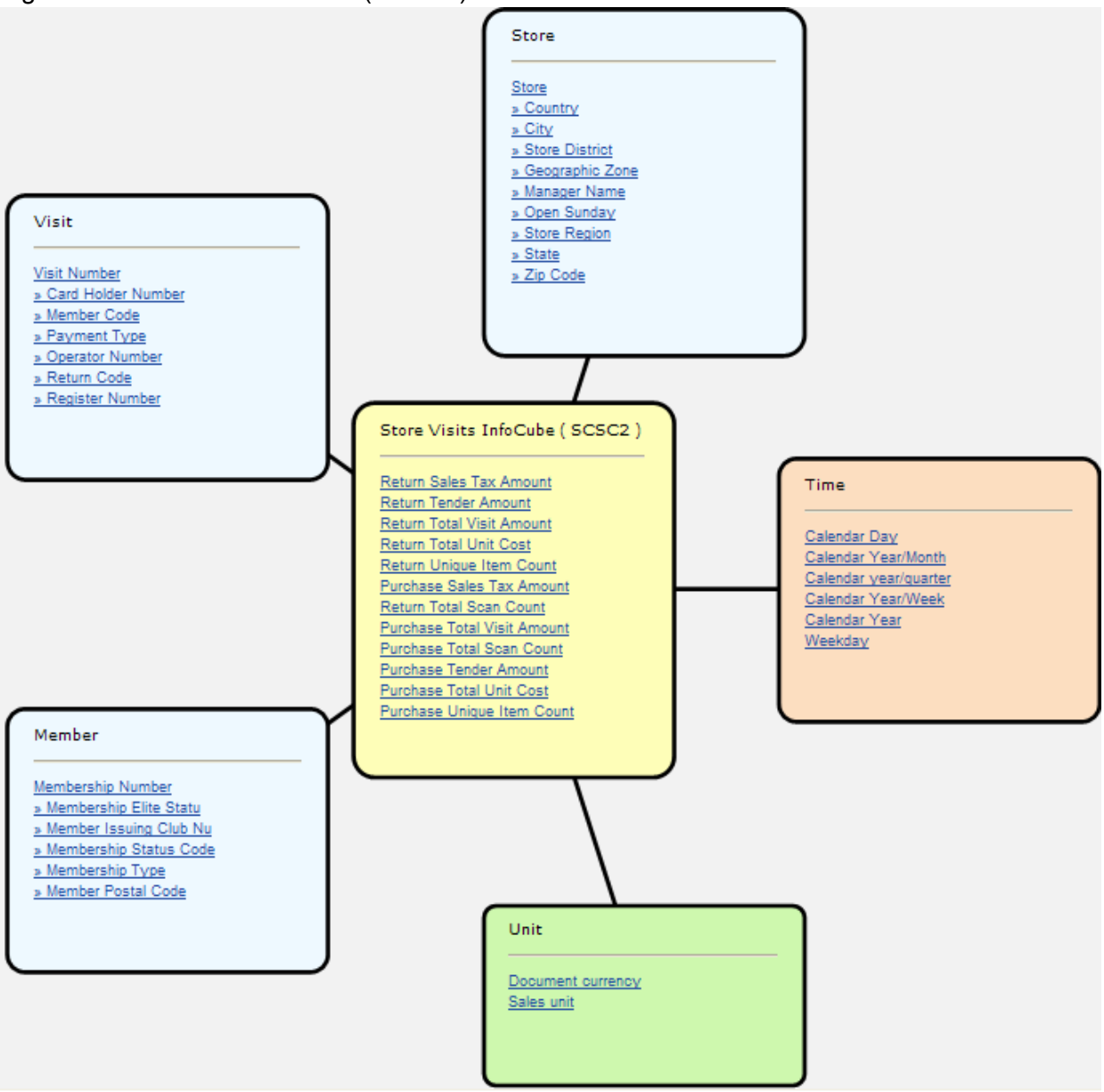
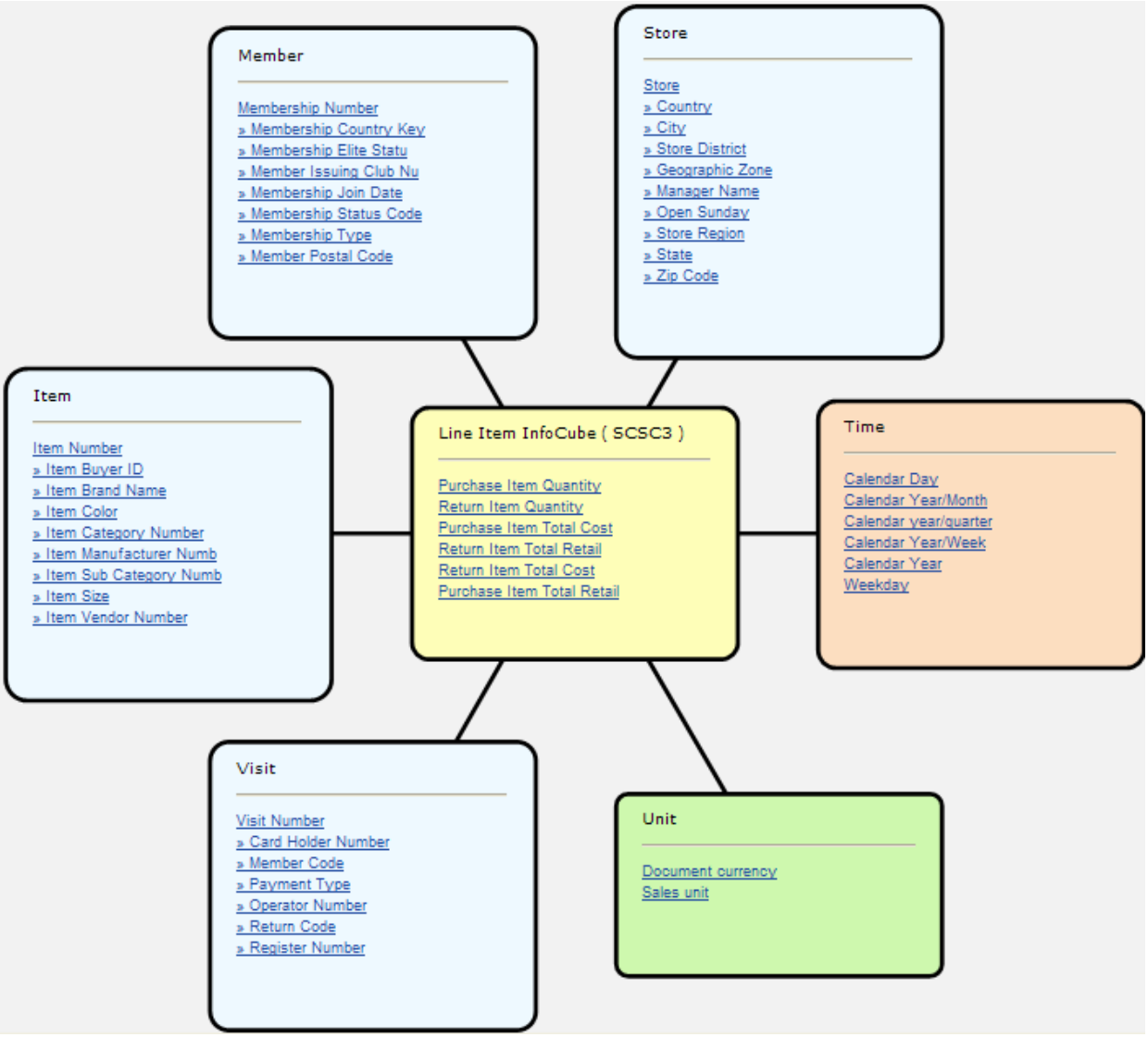


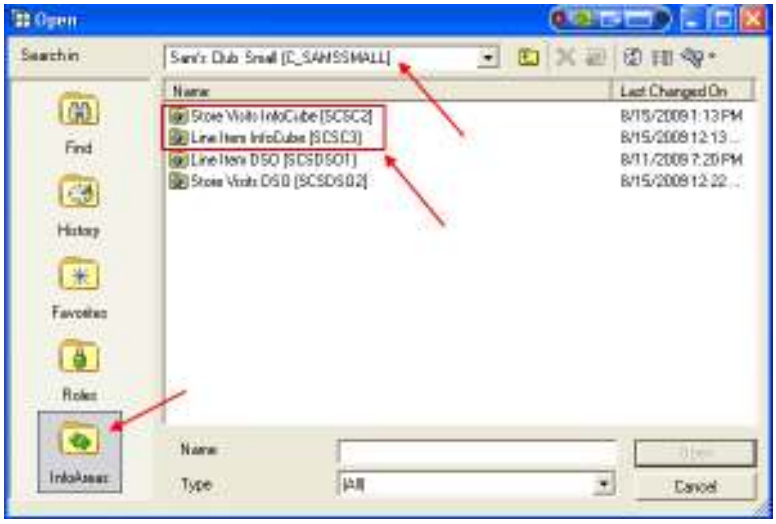
Figure 3: Line Item InfoCube (SCSC3) Star Schema



Query Tips

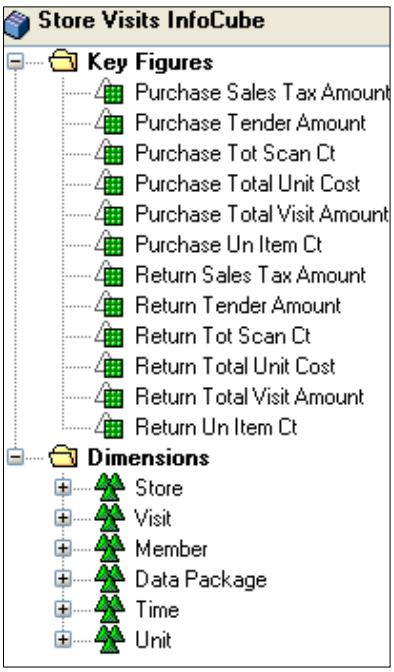
Sam's Club Small InfoArea

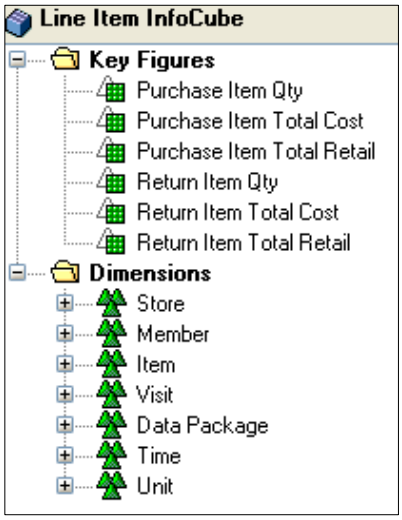
The store visits and line item InfoCubes can be accessed for running existing queries or creating new ones by either searching for the technical names (SCSC2 or SCSC3) or navigating to the Sam's Club Small InfoArea (see below) on the University of Arkansas BI server.



No Calculated/Restricted Key Figures

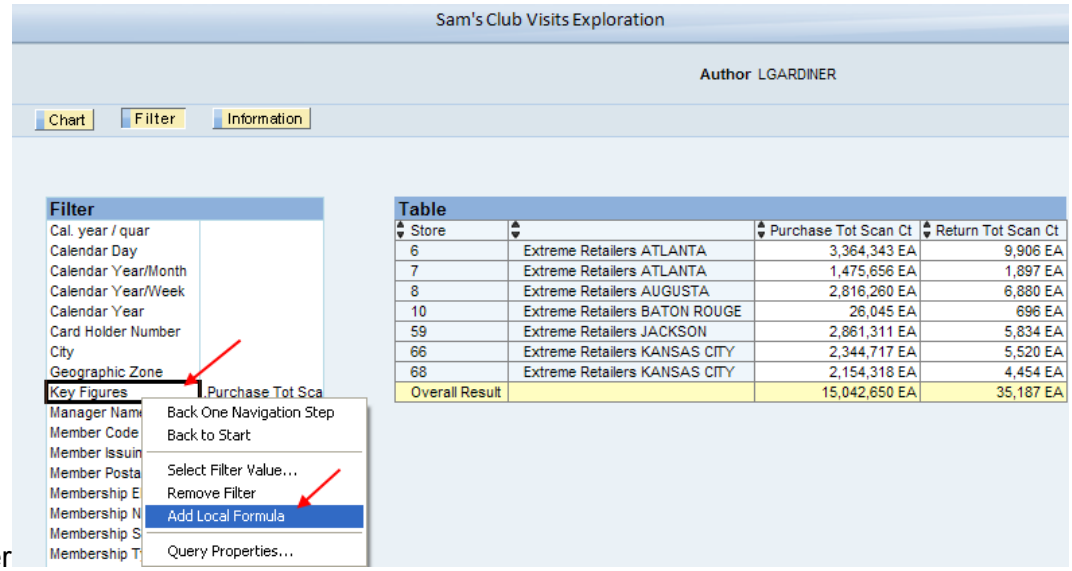
The abbreviated data models from BEx Query Designer (shown below) illustrate that there are no calculated and restricted key figures associated with either InfoCube. The omission of calculated and restricted key figures is intentional to allow faculty to ask students to determine what derived key figures might be useful.





Please ask your students not to create calculated and restricted key figures for these InfoCubes since they will be available for all subsequent queries. Rather, encourage students to use either local formulas in Analyzer or formulas in Query Designer (shown below) since neither will be directly available for other students' queries.

Local Formula in Analyzer



Formula in Query Designer

Store Visits and Line Item InfoCube Incomparability

Comparisons between the measurements in the two InfoCubes cannot be made for two reasons. The first is the scrubbing of the cost and sales data inherent in the source Teradata dataset. The second relates to the item category restrictions placed on the data extractions. While the store visit records were restricted to those containing items from the 11 product

categories listed in Table 10 above, store visit measurements such as the total scan count could include additional categories. For this reason, the total item quantities are larger in the Store Visits InfoCube, as shown in the query results provided below.

Store Visits InfoCube Totals

Store		Purchase Tot Scan Ct	Return Tot Scan Ct
6	Extreme Retailers ATLANTA	3,364,343 EA	9,906 EA
7	Extreme Retailers ATLANTA	1,475,656 EA	1,897 EA
8	Extreme Retailers AUGUSTA	2,816,260 EA	6,880 EA
10	Extreme Retailers BATON ROUGE	26,045 EA	696 EA
59	Extreme Retailers JACKSON	2,861,311 EA	5,834 EA
66	Extreme Retailers KANSAS CITY	2,344,717 EA	5,520 EA
68	Extreme Retailers KANSAS CITY	2,154,318 EA	4,454 EA
Overall Result		15,042,650 EA	35,187 EA

Line Item InfoCube Totals

Store		Purchase Item Qty	Return Item Qty
6	Extreme Retailers ATLANTA	772,429 EA	4,604 EA
7	Extreme Retailers ATLANTA	354,990 EA	1,290 EA
8	Extreme Retailers AUGUSTA	719,594 EA	4,131 EA
10	Extreme Retailers BATON ROUGE	24,316 EA	561 EA
59	Extreme Retailers JACKSON	695,768 EA	3,577 EA
66	Extreme Retailers KANSAS CITY	549,045 EA	2,677 EA
68	Extreme Retailers KANSAS CITY	539,150 EA	2,278 EA
Overall Result		3,655,292 EA	19,118 EA

Store Visit Distribution over Time

The uneven distribution of visits by store over time in the Teradata UA_SAMSCLUB_SMALL dataset (Table 3 above) can distort analysis conclusions if not understood. Totals across returns and purchases (calculated with local query formulas) are summarized below by month for each store. Stores 59 and 66 are the only stores with visit data every month. Given that the transaction dates start at 7/31/2005, these two stores have significantly smaller totals for July 2005. All stores have smaller totals for November 2006 due to the end date of 11/03/2006.

Store Visits InfoCube Scan Count Totals

	Total Scan Count							
Calendar Year/Month\Store	6	7	8	10	59	66	68	Overall Result
07.2005					9,160 EA	9,482 EA		18,642 EA
08.2005					173,824 EA	160,581 EA		334,405 EA
09.2005					160,600 EA	148,003 EA		308,603 EA
10.2005					158,731 EA	156,352 EA		315,083 EA
11.2005					166,171 EA	154,753 EA		320,924 EA
12.2005					246,964 EA	204,549 EA		451,513 EA
01.2006	78,082 EA				166,325 EA	126,165 EA		370,572 EA
02.2006	329,102 EA				173,376 EA	130,157 EA		632,635 EA
03.2006	340,443 EA		195,049 EA		189,893 EA	144,367 EA	3,298 EA	873,050 EA
04.2006	343,551 EA		342,186 EA		187,199 EA	144,355 EA	9,602 EA	1,026,893 EA
05.2006	379,278 EA		386,759 EA	2 EA	210,577 EA	161,264 EA	343,989 EA	1,481,869 EA
06.2006	391,052 EA	167,305 EA	380,967 EA	535 EA	216,592 EA	161,306 EA	386,248 EA	1,704,005 EA
07.2006	379,904 EA	375,014 EA	367,165 EA	2,321 EA	205,185 EA	157,062 EA	372,396 EA	1,859,047 EA
08.2006	379,595 EA	318,012 EA	382,332 EA	4,105 EA	203,268 EA	159,531 EA	371,799 EA	1,818,642 EA
09.2006	369,801 EA	300,757 EA	375,941 EA	6,968 EA	196,640 EA	162,989 EA	337,125 EA	1,750,221 EA
10.2006	366,279 EA	300,660 EA	374,056 EA	11,742 EA	191,022 EA	159,291 EA	315,093 EA	1,718,143 EA
11.2006	17,162 EA	15,805 EA	18,685 EA	1,068 EA	11,618 EA	10,030 EA	19,222 EA	93,590 EA
Overall Result	3,374,249 EA	1,477,553 EA	2,823,140 EA	26,741 EA	2,867,145 EA	2,350,237 EA	2,158,772 EA	15,077,837 EA

Line Item InfoCube Item Quantity Totals

	Total Item Quantity							
Calendar Year/Month\Store	6	7	8	10	59	66	68	Overall Result
07.2005					2,518 EA	2,496 EA		5,014 EA
08.2005					48,144 EA	42,132 EA		90,276 EA
09.2005					42,382 EA	35,657 EA		78,039 EA
10.2005					39,830 EA	35,669 EA		75,499 EA
11.2005					41,581 EA	34,165 EA		75,746 EA
12.2005					55,937 EA	44,322 EA		100,259 EA
01.2006	16,880 EA				39,591 EA	28,271 EA		84,742 EA
02.2006	75,315 EA				41,638 EA	28,737 EA		145,690 EA
03.2006	79,688 EA		50,714 EA		44,834 EA	32,453 EA	1,708 EA	209,397 EA
04.2006	76,790 EA		87,097 EA		43,353 EA	32,291 EA	4,939 EA	244,470 EA
05.2006	88,384 EA		97,606 EA	2 EA	49,346 EA	37,529 EA	83,839 EA	356,706 EA
06.2006	92,487 EA	39,242 EA	97,069 EA	535 EA	52,178 EA	38,288 EA	95,070 EA	414,869 EA
07.2006	89,669 EA	91,980 EA	93,221 EA	2,210 EA	50,932 EA	38,212 EA	92,456 EA	458,680 EA
08.2006	88,123 EA	79,785 EA	102,599 EA	3,797 EA	51,892 EA	40,694 EA	94,713 EA	461,603 EA
09.2006	84,460 EA	70,870 EA	95,844 EA	6,568 EA	47,290 EA	39,476 EA	83,812 EA	428,320 EA
10.2006	81,142 EA	70,728 EA	94,520 EA	10,800 EA	45,120 EA	38,912 EA	79,670 EA	420,892 EA
11.2006	4,095 EA	3,675 EA	5,055 EA	965 EA	2,779 EA	2,418 EA	5,221 EA	24,208 EA
Overall Result	777,033 EA	356,280 EA	723,725 EA	24,877 EA	699,345 EA	551,722 EA	541,428 EA	3,674,410 EA

Metadata Issues

The characteristic master data is limited by the absence or brevity of metadata for certain Teradata dataset attributes. For example, member attributes have values but no description for their meaning (e.g., Membership Type = A). In some cases, only a portion of the characteristic values in the master data have metadata descriptions. For example, the Teradata Tender_Type metadata contains definitions for six values but there are nine values in the UA_SAMSCLUB_SMALL dataset. As a result, the master data for Payment Type contains no descriptions for the last three types, as shown below.

Payment Type Example

Payment Type		Purchase Item Qty	Return Item Qty
0	CASH	1,103,978 EA	14,130 EA
1	CHECK	1,554,611 EA	482 EA
3	GIFT CARD	414,773 EA	2,264 EA
4	DISCOVER	15,374 EA	198 EA
5	BUSINESS CREDIT	95,950 EA	709 EA
6	PERSONAL CREDIT	183,480 EA	841 EA
7	7	12,119 EA	313 EA
8	8	5,510 EA	110 EA
9	9	269,497 EA	71 EA
Overall Result		3,655,292 EA	19,118 EA

Unassigned Values for Characteristics ("#")

Students will need to understand that "#" as a characteristic value means "unassigned." The unassigned values occur due to missing data in the Teradata dataset. For example, there are 175,205 members in the Teradata MEMBER_INDEX used to build master data for the Membership Number characteristic but many more (304,327) in the STORE_VISITS table. This results in a significant number of records with unassigned values for important characteristics, as shown in the Membership Type example below.

Membership Type Example

Membership Type	Purchase Item Qty	Return Item Qty
1	37 EA	0 EA
3	17 EA	0 EA
A	20,606 EA	212 EA
D	1,343 EA	4 EA
E	12,005 EA	169 EA
G	440 EA	1 EA
H	76 EA	1 EA
V	1,236,664 EA	5,567 EA
W	1,138,209 EA	4,805 EA
X	327,325 EA	2,046 EA
Y	9,138 EA	54 EA
Z	2,133 EA	38 EA
#	907,299 EA	6,221 EA

Query Performance

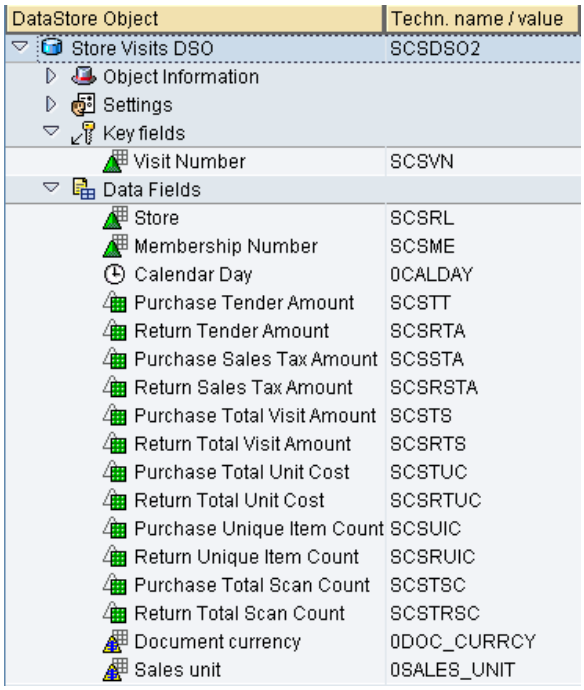
Since the Sam's Club InfoCubes contain transaction detail, query performance was a high priority in their design. Additionally, pre-filled aggregates for common rollups (e.g., store and month) exist for each InfoCube to improve query speed. If faculty encounter rollups for an exercise that are unreasonably slow, contact the author of this report. If appropriate, additional aggregates will be built. Aggregates, however, cannot improve query performance for transaction detail analysis. To improve the response time for detail requests such as Visit Number or Membership Number, encourage students to filter on characteristics or place restrictive conditions on key figure values.

Technical Appendix

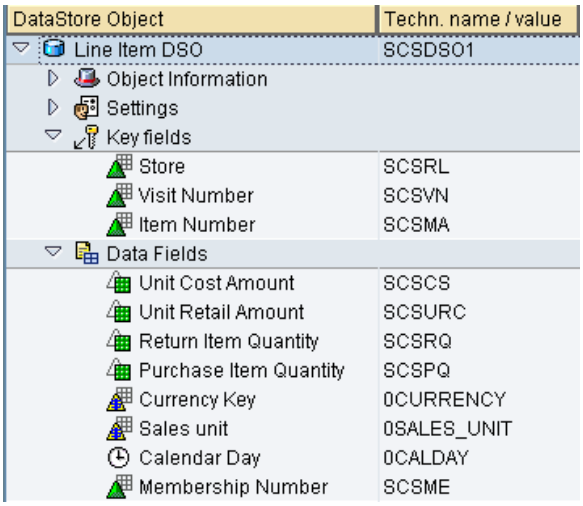
Consistent with industry practice, the architecture includes two DataStore Objects (DSOs) containing historical details from which InfoCube data marts can be built. While the existing Store Visit and Line Item InfoCubes have the same granularity as the DSOs, it is important to note that other, more aggregated InfoCubes could be built and easily loaded from the existing DSOs, if desired.

DSO Definitions

The DSO key fields are consistent with the primary keys in the respective UA_SAMSCLUB_SMALL Store_Visits and Item_Scan tables. Additionally, key figures are populated for purchases and returns using transformations involving the Refund_Code and original quantities from the PSA.



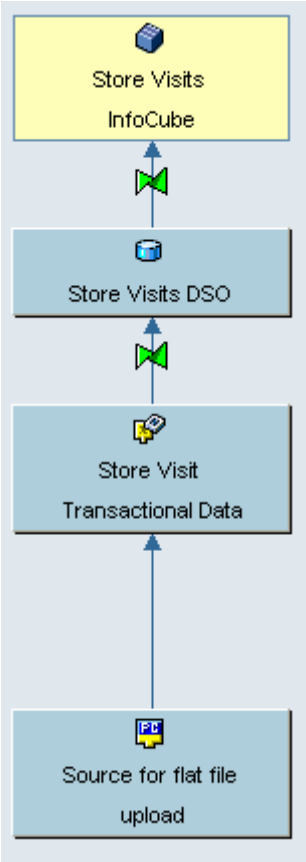
DataStore Object	Techn. name / value
Store Visits DSO	SCSDSO2
Object Information	
Settings	
Key fields	
Visit Number	SCSVN
Data Fields	
Store	SCSRL
Membership Number	SCSME
Calendar Day	0CALDAY
Purchase Tender Amount	SCSTT
Return Tender Amount	SCSRTA
Purchase Sales Tax Amount	SCSSTA
Return Sales Tax Amount	SCSRSTA
Purchase Total Visit Amount	SCSTS
Return Total Visit Amount	SCSRTS
Purchase Total Unit Cost	SCSTUC
Return Total Unit Cost	SCSRTUC
Purchase Unique Item Count	SCSUIC
Return Unique Item Count	SCSRUIC
Purchase Total Scan Count	SCSTSC
Return Total Scan Count	SCSTRSC
Document currency	0DOC_CURRCY
Sales unit	0SALES_UNIT

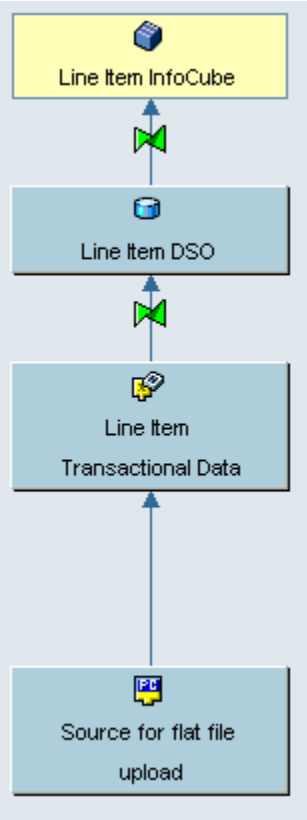


DataStore Object	Techn. name / value
Line Item DSO	SCSDSO1
Object Information	
Settings	
Key fields	
Store	SCSRL
Visit Number	SCSVN
Item Number	SCSMA
Data Fields	
Unit Cost Amount	SCSCS
Unit Retail Amount	SCSURC
Return Item Quantity	SCSRQ
Purchase Item Quantity	SCSPQ
Currency Key	0CURRENCY
Sales unit	0SALES_UNIT
Calendar Day	0CALDAY
Membership Number	SCSME

Data Flow

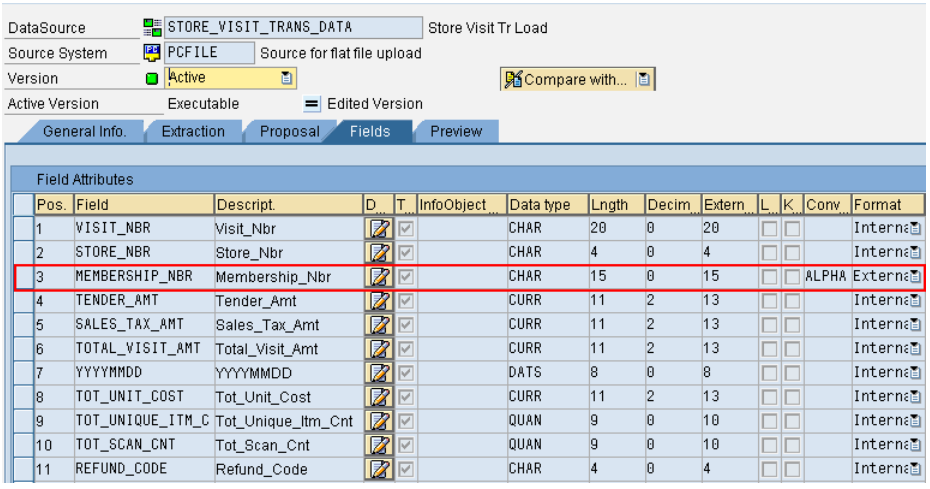
The data flow for each InfoCube is provided below. Transactional data extractions into .csv file from UA_SAMSCLUB_SMALL were used to populate the PSA tables. From there, Data Transfer Processes loaded data into the DSOs and subsequent InfoCubes, executing the necessary transformations. [Master data flows are not shown but were straightforward loads of characteristics with texts and attributes, as needed, from the respective UA_SAMSCLUB_SMALL tables.





Data Source Fields

For both the store visit and line item PSA tables, all the fields are in internal format except the Membership_Nbr. This field requires the ALPHA conversion method from external to internal format because, as noted in the Faculty Summary, there are many member numbers that are not in the UA_SAMSCLUB_SMALL Member_Index table. For this reason, the ALPHA conversion did not occur in a master data load for the missing numbers. Failure to request the ALPHA conversion results in activation problems in the DSO.

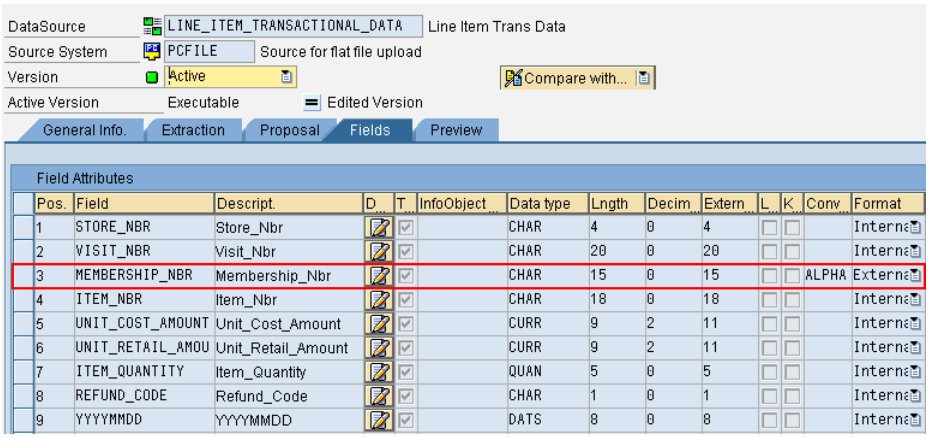


DataSource: STORE_VISIT_TRANS_DATA — Store Visit Tr Load
Source System: PCFILE — Source for flat file upload
Version: Active — Compare with...
Active Version: Executable — Edited Version

General Info. | Extraction | Proposal | Fields | Preview

Field Attributes

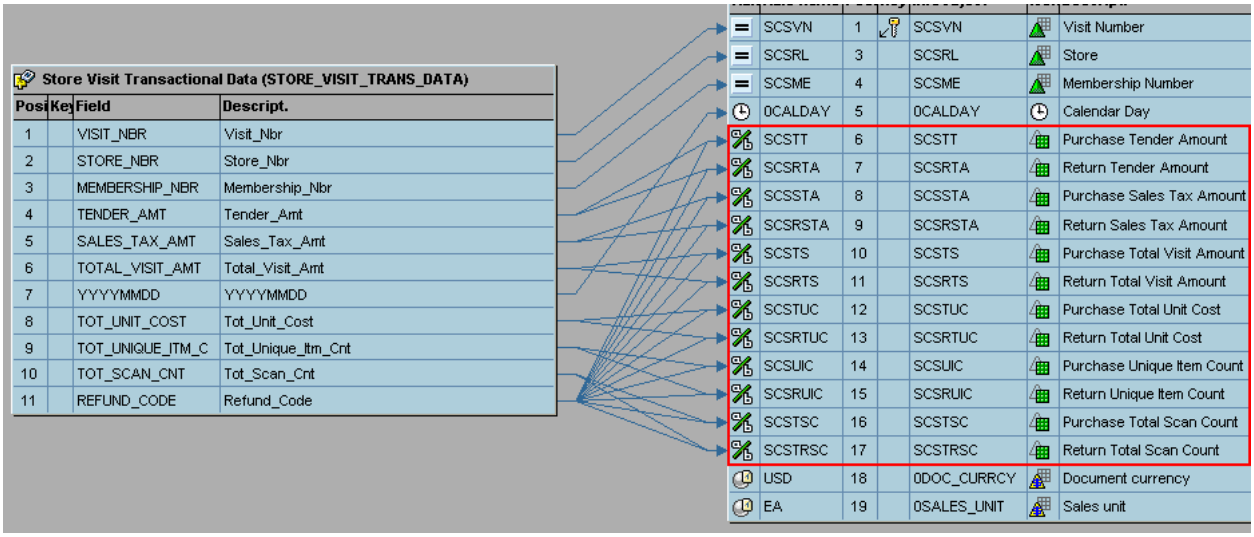
Pos.	Field	Descript.	D	T	InfoObject	Data type	Lngth	Decim	Extern	L	K	Conv	Format
1	VISIT_NBR	Visit_Nbr				CHAR	20	0	20				Interna
2	STORE_NBR	Store_Nbr				CHAR	4	0	4				Interna
3	MEMBERSHIP_NBR	Membership_Nbr				CHAR	15	0	15			ALPHA	Externa
4	TENDER_AMT	Tender_Amt				CURR	11	2	13				Interna
5	SALES_TAX_AMT	Sales_Tax_Amt				CURR	11	2	13				Interna
6	TOTAL_VISIT_AMT	Total_Visit_Amt				CURR	11	2	13				Interna
7	YYYYMMDD	YYYYMMDD				DATS	8	0	8				Interna
8	TOT_UNIT_COST	Tot_Unit_Cost				CURR	11	2	13				Interna
9	TOT_UNIQUE_ITM_C	Tot_Unique_Itm_Cnt				QUAN	9	0	10				Interna
10	TOT_SCAN_CNT	Tot_Scan_Cnt				QUAN	9	0	10				Interna
11	REFUND_CODE	Refund_Code				CHAR	4	0	4				Interna



Pos.	Field	Descript.	D	T	InfoObject	Data type	Lngth	Decim	Extern	L	K	Conv	Format
1	STORE_NBR	Store_Nbr				CHAR	4	0	4				Interna
2	VISIT_NBR	Visit_Nbr				CHAR	20	0	20				Interna
3	MEMBERSHIP_NBR	Membership_Nbr				CHAR	15	0	15			ALPHA	Externa
4	ITEM_NBR	Item_Nbr				CHAR	18	0	18				Interna
5	UNIT_COST_AMOUNT	Unit_Cost_Amount				CURR	9	2	11				Interna
6	UNIT_RETAIL_AMOU	Unit_Retail_Amount				CURR	9	2	11				Interna
7	ITEM_QUANTITY	Item_Quantity				QUAN	5	0	5				Interna
8	REFUND_CODE	Refund_Code				CHAR	1	0	1				Interna
9	YYYYMMDD	YYYYMMDD				DATS	8	0	8				Interna

Transformations: PSA to DSO

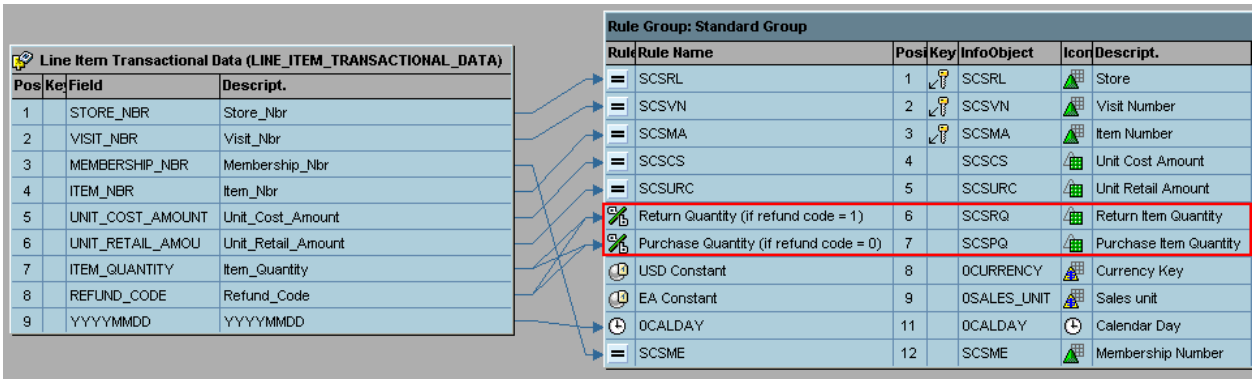
The transformations for the store visits and line item DSOs are shown below. Of particular note are the transformations using Refund_Code that populate the purchase and return key figure data upon execution. An example is provided for Purchase Tender Amount that typifies the purchase/return key figure transformations.



Store Visit Transactional Data (STORE_VISIT_TRANS_DATA)

Posi	Key	Field	Descript.
1		VISIT_NBR	Visit_Nbr
2		STORE_NBR	Store_Nbr
3		MEMBERSHIP_NBR	Membership_Nbr
4		TENDER_AMT	Tender_Amt
5		SALES_TAX_AMT	Sales_Tax_Amt
6		TOTAL_VISIT_AMT	Total_Visit_Amt
7		YYYYMMDD	YYYYMMDD
8		TOT_UNIT_COST	Tot_Unit_Cost
9		TOT_UNIQUE_ITM_C	Tot_Unique_Itm_Cnt
10		TOT_SCAN_CNT	Tot_Scan_Cnt
11		REFUND_CODE	Refund_Code

SCSVN	1		SCSVN		Visit Number
SCSRL	3		SCSRL		Store
SCSME	4		SCSME		Membership Number
0CALDAY	5		0CALDAY		Calendar Day
SCSTT	6		SCSTT		Purchase Tender Amount
SCSRTA	7		SCSRTA		Return Tender Amount
SCSSTA	8		SCSSTA		Purchase Sales Tax Amount
SCSRSTA	9		SCSRSTA		Return Sales Tax Amount
SCSTS	10		SCSTS		Purchase Total Visit Amount
SCSRTS	11		SCSRTS		Return Total Visit Amount
SCSTUC	12		SCSTUC		Purchase Total Unit Cost
SCSRTUC	13		SCSRTUC		Return Total Unit Cost
SCSUIC	14		SCSUIC		Purchase Unique Item Count
SCSRUIC	15		SCSRUIC		Return Unique Item Count
SCSTSC	16		SCSTSC		Purchase Total Scan Count
SCSTRSC	17		SCSTRSC		Return Total Scan Count
USD	18		0DOC_CURRCY		Document currency
EA	19		0SALES_UNIT		Sales unit



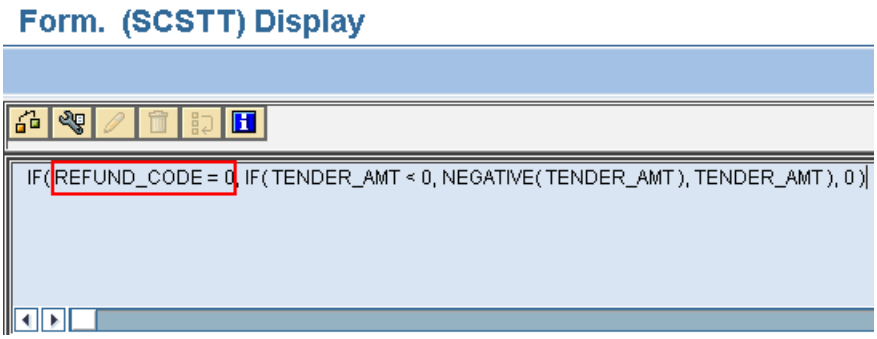
Line Item Transactional Data (LINE_ITEM_TRANSACTIONAL_DATA)

Pos	Ke	Field	Descript.
1		STORE_NBR	Store_Nbr
2		VISIT_NBR	Visit_Nbr
3		MEMBERSHIP_NBR	Membership_Nbr
4		ITEM_NBR	Item_Nbr
5		UNIT_COST_AMOUNT	Unit_Cost_Amount
6		UNIT_RETAIL_AMOU	Unit_Retail_Amount
7		ITEM_QUANTITY	Item_Quantity
8		REFUND_CODE	Refund_Code
9		YYYYMMDD	YYYYMMDD

Rule Group: Standard Group

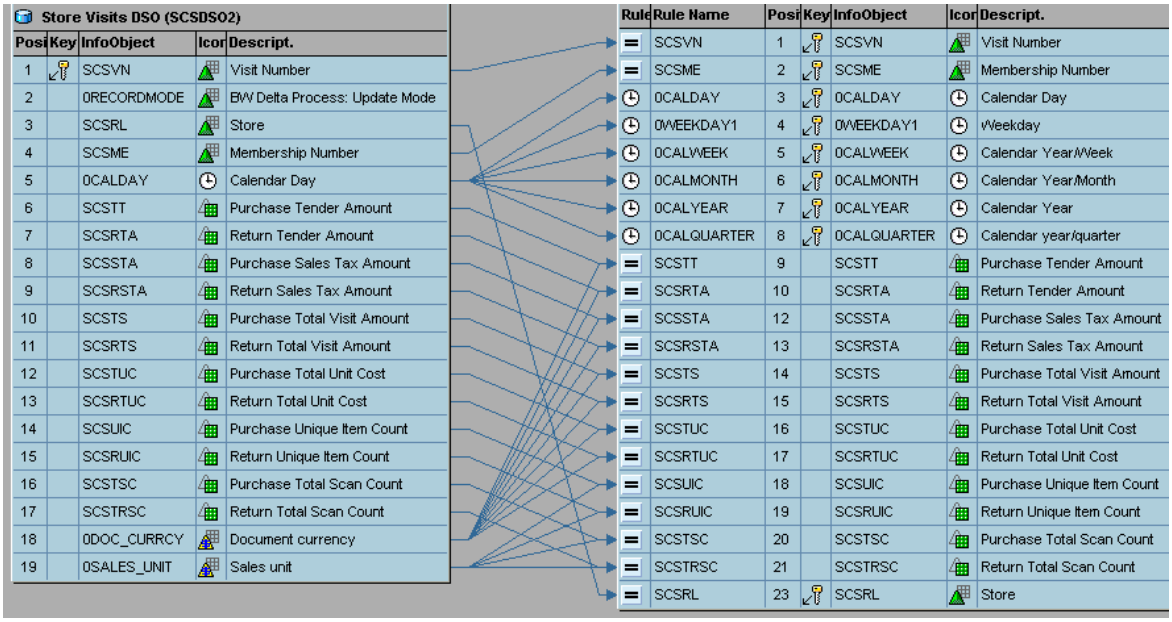
Rule	Rule Name	Posi	Key	InfoObject	Icon	Descript.
	SCSRL	1		SCSRL		Store
	SCSVN	2		SCSVN		Visit Number
	SCSMA	3		SCSMA		Item Number
	SCSCS	4		SCSCS		Unit Cost Amount
	SCSURC	5		SCSURC		Unit Retail Amount
	Return Quantity (if refund code = 1)	6		SCSRQ		Return Item Quantity
	Purchase Quantity (if refund code = 0)	7		SCSPQ		Purchase Item Quantity
	USD Constant	8		0CURRENCY		Currency Key
	EA Constant	9		0SALES_UNIT		Sales unit
	0CALDAY	11		0CALDAY		Calendar Day
	SCSME	12		SCSME		Membership Number

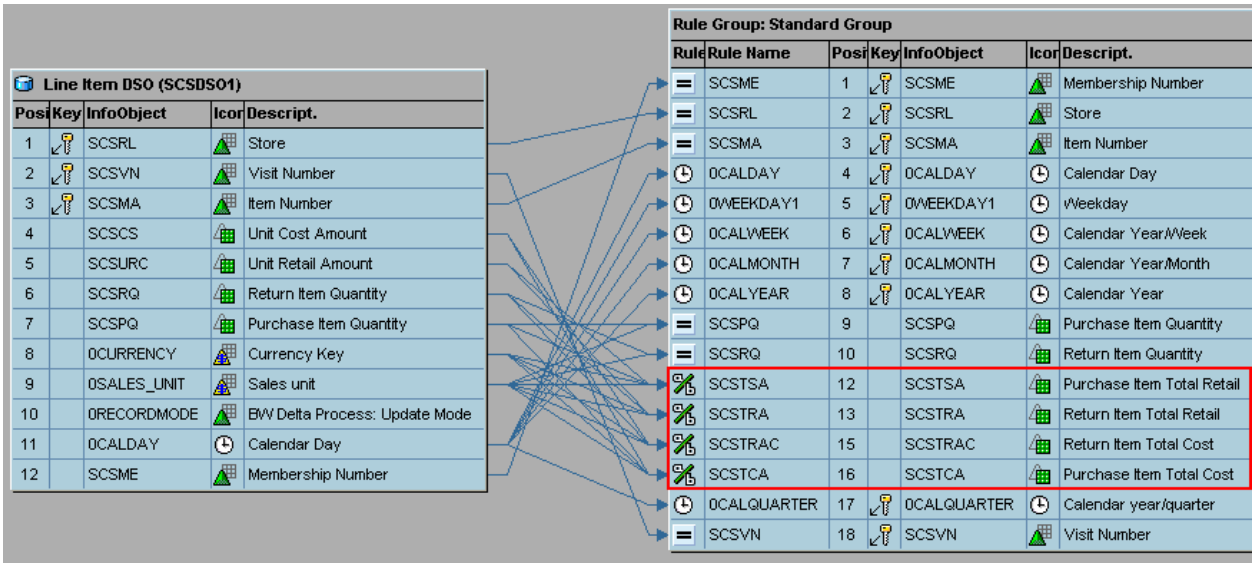
The Purchase Tender Amount formula is conditioned on a Refund_Code value of zero (purchase) and also forces all values to be positive. Formulas for return-based key figures are conditioned on Refund_Code values of 1.



Transformations: DSO to InfoCube

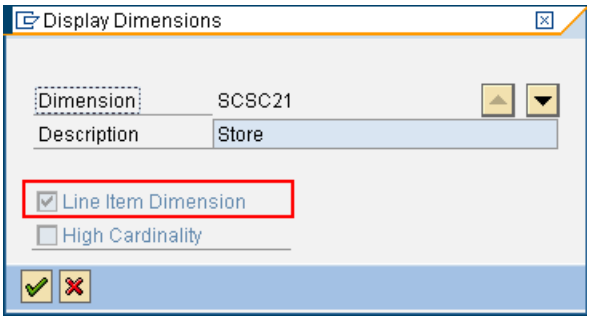
The store visits transformations are all direct or time-based while those for the line item InfoCube require four simple transformation (Quantity*Unit Cost or Unit Retail).



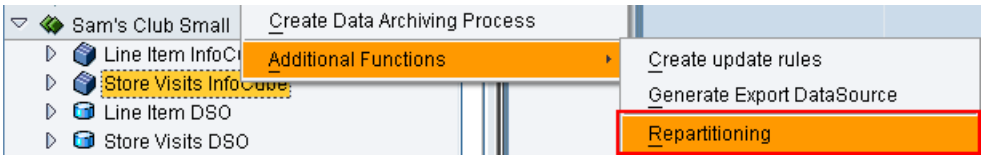


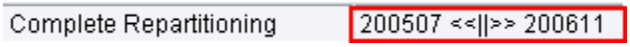
Query Performance Enhancement

Since both InfoCubes are highly granular, particular attention was paid to query speed in the InfoCube design and maintenance of aggregates. All dimensions are designated as line item. As an example, a Store dimension line item designation is shown below.



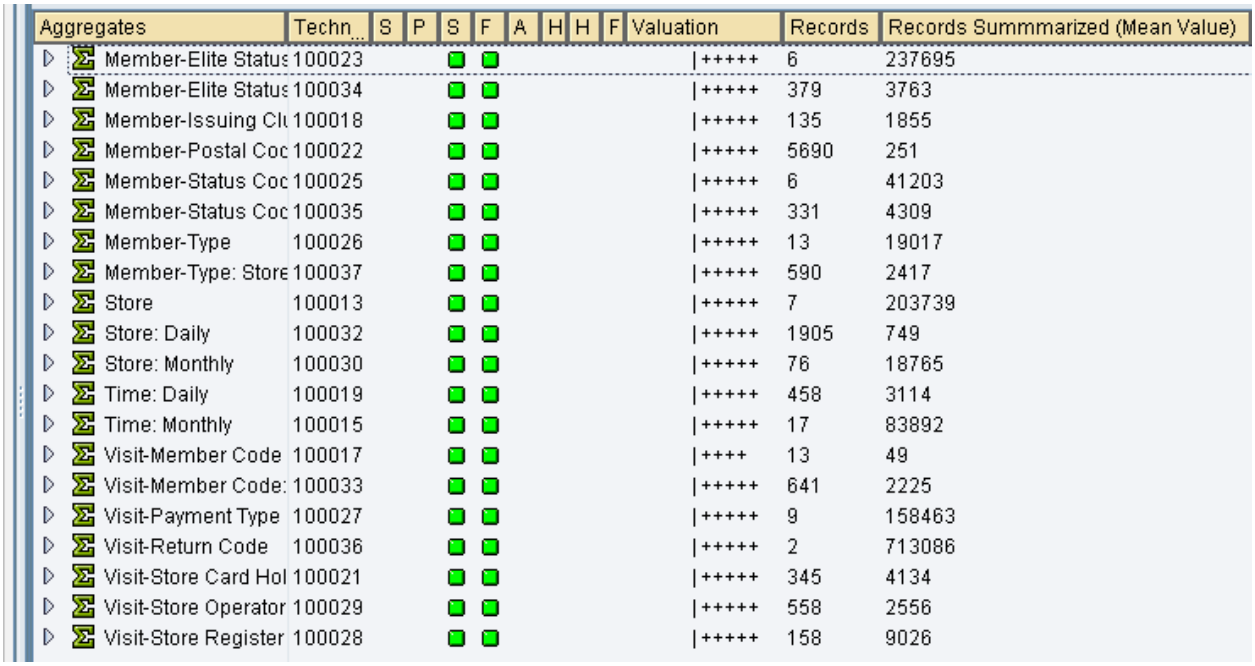
Additionally, each InfoCube is partitioned on month, from May 2005 through November 2006.





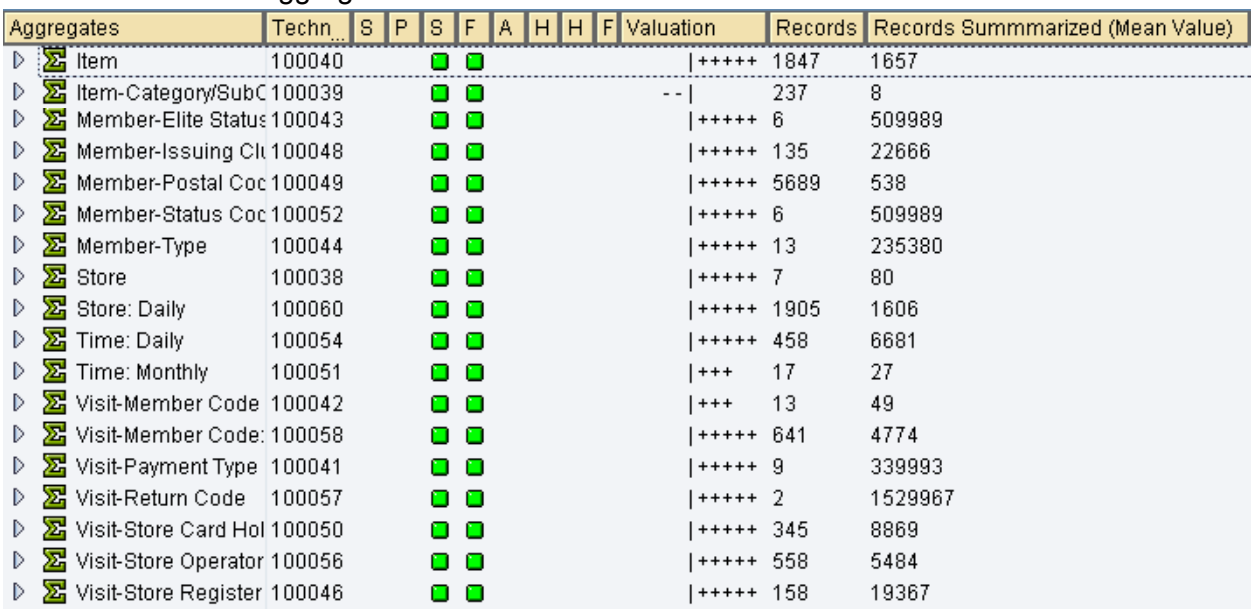
Finally, each InfoCube has a number of aggregates that reflect the most likely query requests. The author will supplement the aggregate collection, as needed, to improve performance. The current set of aggregates for each InfoCube is shown below.

Store Visit InfoCube
Aggregates



Aggregates	Techn...	S	P	S	F	A	H	H	F	Valuation	Records	Records Summmarized (Mean Value)
Member-Elite Status	100023									|+++++	6	237695
Member-Elite Status	100034									|+++++	379	3763
Member-Issuing Cl	100018									|+++++	135	1855
Member-Postal Coc	100022									|+++++	5690	251
Member-Status Coc	100025									|+++++	6	41203
Member-Status Coc	100035									|+++++	331	4309
Member-Type	100026									|+++++	13	19017
Member-Type: Store	100037									|+++++	590	2417
Store	100013									|+++++	7	203739
Store: Daily	100032									|+++++	1905	749
Store: Monthly	100030									|+++++	76	18765
Time: Daily	100019									|+++++	458	3114
Time: Monthly	100015									|+++++	17	83892
Visit-Member Code	100017									|++++	13	49
Visit-Member Code:	100033									|+++++	641	2225
Visit-Payment Type	100027									|+++++	9	158463
Visit-Return Code	100036									|+++++	2	713086
Visit-Store Card Hol	100021									|+++++	345	4134
Visit-Store Operator	100029									|+++++	558	2556
Visit-Store Register	100028									|+++++	158	9026

Line Item InfoCube Aggregates



Aggregates	Techn...	S	P	S	F	A	H	H	F	Valuation	Records	Records Summmarized (Mean Value)
Item	100040									|+++++	1847	1657
Item-Category/SubC	100039									--|	237	8
Member-Elite Status	100043									|+++++	6	509989
Member-Issuing Cl	100048									|+++++	135	22666
Member-Postal Coc	100049									|+++++	5689	538
Member-Status Coc	100052									|+++++	6	509989
Member-Type	100044									|+++++	13	235380
Store	100038									|+++++	7	80
Store: Daily	100060									|+++++	1905	1606
Time: Daily	100054									|+++++	458	6681
Time: Monthly	100051									|+++	17	27
Visit-Member Code	100042									|+++	13	49
Visit-Member Code:	100058									|+++++	641	4774
Visit-Payment Type	100041									|+++++	9	339993
Visit-Return Code	100057									|+++++	2	1529967
Visit-Store Card Hol	100050									|+++++	345	8869
Visit-Store Operator	100056									|+++++	558	5484
Visit-Store Register	100046									|+++++	158	19367