



12/17/2014

# Board 9 - YCV Improvements

*Has it made any difference?*

Robert Brooke



## Contents

Introduction.....	1
Test Database details .....	2
Entities & Relationships .....	2
Product .....	2
Customer .....	2
Channel .....	3
Time.....	3
Non-Time Entity statistics.....	3
Time Entity Statistics .....	4
Cubes.....	4
Testing methodology .....	5
Test Results.....	6
Summary results.....	6
Detailed Results .....	7
Comparative Cube Performance .....	10
Conclusion .....	10
Postscript .....	10



# Board 9 - YCV Improvements

*Has it made any difference?*

## Introduction

In BOARD 9 an improvement has been made that is of significance for all BOARD developers:

The application of the Cumulative Time Function (like Yearly Cumulated Value) is now more intuitive. The back-end Layout process that rules the calculation of the Cumulated Time Functions ( as YCV, YMT etc.) is changed. It is now driven by the report time dimension (Axis) and no more by the info-cube time dimension.

This paper sets out to test how effective this change is.

Before doing so it should be noted that there is some ambiguity about what cumulative time functions have been changed. The above quote clearly states “....YCV, YMT etc.)...”. However directly below the example given regarding the change the release notes state:

### NOTES

*It is now not necessary any more ad-hoc versioning the info-cube on those dimensions where the cumulated time function needed to be applied.*

**The feature is available for YCV (Yearly Cumulated Value) function only**

(Emphasis mine) So which is it BOARD?

This paper does not test which assertion is correct, though this is certainly a topic worthy of further investigation.

## Test Database details

The database used for testing the effectiveness of this improvements is one that I have created for training purposes and to stress test BOARD. It is based in a training database used by one of BOARDs competitors and is useful for making comparisons with that product. For the purposes of this investigation it is the volume of data that makes it useful for testing this functionality.

Full understanding of the database is not necessary to follow the results. The key structure information is detailed in the following sections.

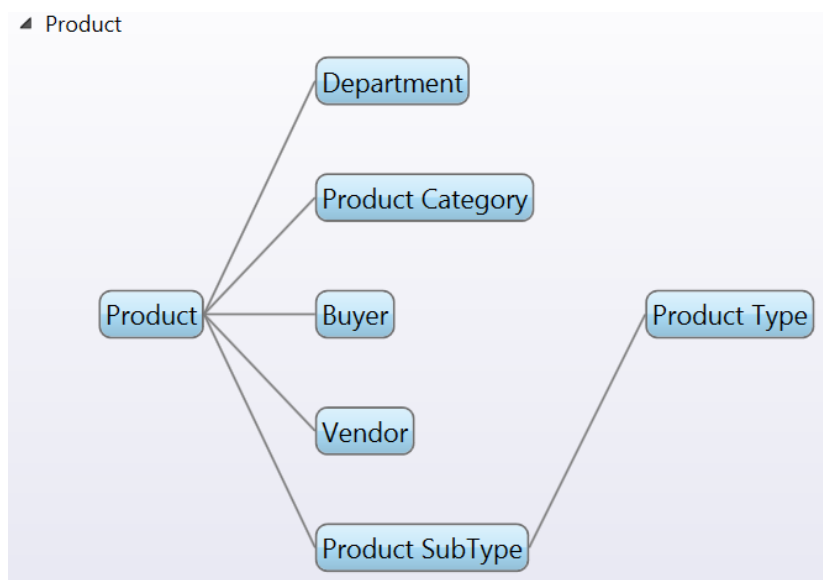
## Entities & Relationships

There are 3 Entity trees based on the following entities:

- Product
- Customer
- Channel

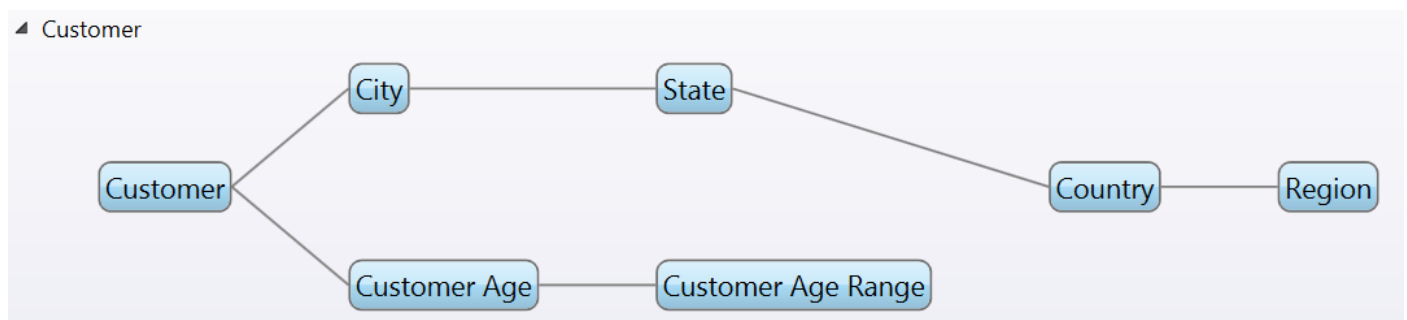
### Product

The Product tree is structured thus:



### Customer

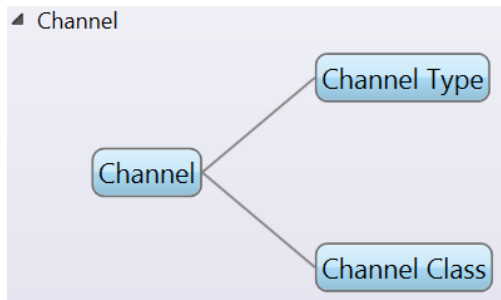
The Customer tree is structured thus:





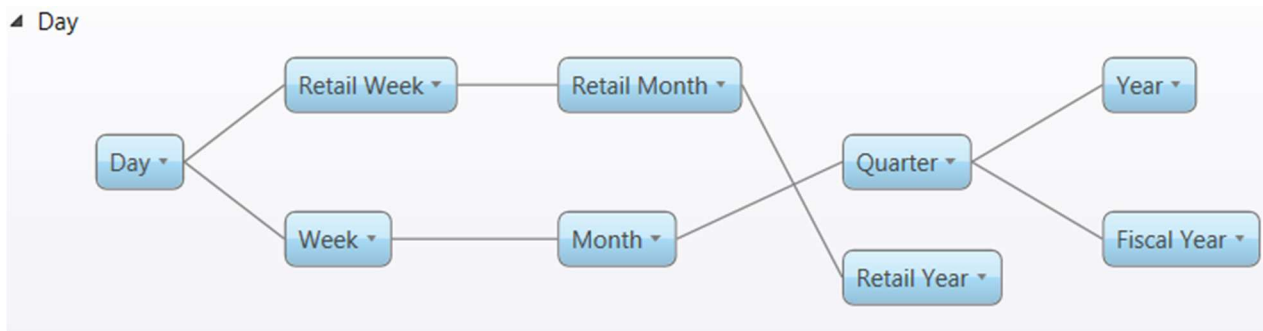
## Channel

The Channel tree is structured thus:



## Time

The time entity does contain custom time entities however for the purposes of this investigation these are not significant as they are not utilized. The Time tree is structured thus:



## Non-Time Entity statistics

The screenshot below shows that the root entities of the Product and Customer trees are quite large. This is significant when it comes to designing appropriate cubes based on these entities.

	Entity	Code Width	Desc Width	Max Item Nr	Sort by	Display	Physical Name	User View	Is Rollup	In use	Members	Item Nr
	Main group											
	Product	5	80	4000	None ▾	Desc ▾	E_000011	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		2,713
	Department	4	50	500	None ▾	Desc ▾	E_000012	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		3
	Product Category	4	50	500	None ▾	Desc ▾	E_000013	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		8
	Product Type	4	50	500	None ▾	Desc ▾	E_000014	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		32
	Product SubType	4	40	250	None ▾	Desc ▾	E_000025	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		146
	Buyer	35	35	250	None ▾	Desc ▾	E_000015	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		12
	Vendor	4	30	500	None ▾	Desc ▾	E_000016	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		257
	Customer	6	60	300000	None ▾	Desc ▾	E_000017	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		253,132
	City	30	60	100000	None ▾	Desc ▾	E_000018	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		59,620
	State	30	30	1000	None ▾	Desc ▾	E_000019	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		181
	Country	20	35	250	None ▾	Desc ▾	E_000020	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		64
	Region	3	30	50	None ▾	Desc ▾	E_000021	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		6
	Customer Age	3	3	120	None ▾	Desc ▾	E_000027	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		65
	Customer Age Range	20	20	10	None ▾	Desc ▾	E_000026	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		4
	Channel	2	30	50	None ▾	Desc ▾	E_000022	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		13
	Channel Type	35	35	10	None ▾	Desc ▾	E_000023	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		6
	Channel Class	2	25	10	None ▾	Desc ▾	E_000024	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		2



## Time Entity Statistics

Entity	Code Width	Desc Width	Sort by	Display	Physical Name	User View	In use	Members	Item Nr
Time Entities									
Month	6	32	None ▾	Desc ▾	E_000001	<input checked="" type="checkbox"/>			72
Bimonth	6	32	None ▾	Desc ▾	E_000002	<input checked="" type="checkbox"/>			0
Quarter	6	32	None ▾	Desc ▾	E_000003	<input checked="" type="checkbox"/>			24
Retail Week	10	32	None ▾	Code ▾	E_000004	<input checked="" type="checkbox"/>			209
Retail Month	10	32	None ▾	Code ▾	E_000005	<input checked="" type="checkbox"/>			48
Year	4	32	None ▾	Desc ▾	E_000006	<input checked="" type="checkbox"/>			6
Day	8	10	None ▾	Desc ▾	E_000007	<input checked="" type="checkbox"/>			2,192
Week	6	32	None ▾	Desc ▾	E_000008	<input checked="" type="checkbox"/>			319
Retail Year	10	32	None ▾	Code ▾	E_000009	<input checked="" type="checkbox"/>			5
Fiscal Year	4	32	None ▾	Desc ▾	E_000010	<input checked="" type="checkbox"/>			7

## Cubes

The cubes used for this investigation are all Sales cubes based on a Sales Fact table in the source SQL data. The Sales information is dimensioned by Customer, Product, Channel and Day. Aggregations through all trees are used in reports.

The simplest cube design for this measure would be this:

Dense Sales	Single						
MDB / RDB							
Query builder							
In RAM							
Delete version							
	1	2	3	4	5	6	7
Day							
Product							
Customer							
Channel							

This design is, from experience, known to be problematic. Pre-BOARD 9, this design would not correctly calculate YCV values, e.g. YCV by Month, YCV by Qtr etc.. Thus additional aggregations were required. This paper will not look at the optimal cube version design as that is not its purpose.



## Testing methodology

A number of different cube version designs were tested. This process involved the following steps:

- Set up standard build:
  - Build standard cube - see screenshot 'Dense Sales' above
  - Build a standard SQL datareader based on 'Dense Sales'
  - Build a standard screen based on 'Dense Sales' cube
- Build test cubes:
  - Build a cube with a different design cloned from standard build cube
  - Build a standard SQL datareader cloned from standard build then change the cube reference
  - Clone the standard screen report and replace 'Dense Sales' cube references with reference to new test cube
- Reload database:
  - Clear and reload all entities, relationships and cubes
- Reset environment:
  - Unload database
  - Stop/Start BOARD service
  - Attach the database
- Run Reports:
  - Open the test reporting capsule
  - Open each report screen
- Check capsule log for timing results and to verify which cube versions are used

The standard build report screen contained these 2 layouts:

	Sales	Sales YTD
Jan.09	14,613,665.22	14,613,665.22
Feb.09	11,302,822.98	25,916,488.20
Mar.09	15,515,254.21	41,431,742.41
Apr.09	10,931,516.11	52,363,258.52
May.09	11,120,135.53	63,483,394.05
Jun.09	13,218,678.11	76,702,072.16
Jul.09	12,072,258.29	88,774,330.45
Aug.09	13,284,961.80	102,059,292.25
Sep.09	13,130,795.09	115,190,087.34
Oct.09	11,944,181.20	127,134,268.54
Nov.09	13,016,563.15	140,150,831.69
Dec.09	18,068,267.76	158,219,099.45
TOTAL	158,219,099.45	

	Sales	Sales YTD
Q.1/09	41,431,742.41	41,431,742.41
Q.2/09	35,270,329.75	76,702,072.16
Q.3/09	38,488,015.18	115,190,087.34
Q.4/09	43,029,012.11	158,219,099.45
TOTAL	158,219,099.45	

The dataview on the left is Sales by Month and YCV by month; on the right is Sales by Quarter and YCV by quarter.

Historically BOARD could produce neither dataview accurately unless cube versions were created that included Month and Quarter in their definition. Without those versions BOARD would render a dataview, however it took approximately 45 minutes to produce the monthly YCV report, and the values were incorrect.





## Test Results

### Summary results

The following table shows an overview of the results from various cube definitions and their associated reports.

Report Title	Cube	Version	Layout Time	In Secs	Screen Total in Secs
B9Sales MultiTimeVersion [CustRegAgg]	B9 Sales Multi Version [CustRegAgg]	v007	00h00m01s	1	
B9Sales MultiTimeVersion [CustRegAgg]	B9 Sales Multi Version [CustRegAgg]	v008	00h00m01s	1	2
B9Sales MultiTimeVersion [ProdDeptAgg]	B9 Sales Multi Version [ProdDeptAgg]	v007	00h00m07s	7	
B9Sales MultiTimeVersion [ProdDeptAgg]	B9 Sales Multi Version [ProdDeptAgg]	v008	00h00m09s	9	16
TrainingSample4 by Month	Sales	v011	00h00m14s	14	
TrainingSample4 by Month	Sales	v012	00h00m06s	6	20
B9Sales SingleTimeVersion [CustRegAgg]	B9 Sales SingleTimeVersion [CustRegAgg]	v002	00h00m09s	9	
B9Sales SingleTimeVersion [CustRegAgg]	B9 Sales SingleTimeVersion [CustRegAgg]	v002	00h00m13s	13	22
B9Sales MultiTimeVersion [AllSparse]	B9 Sales MultiTimeVersion [AllSparse]	v003	00h00m21s	21	
B9Sales MultiTimeVersion [AllSparse]	B9 Sales MultiTimeVersion [AllSparse]	v004	00h00m29s	29	50
B9Sales	B9 Sales	v002	00h00m20s	20	
B9Sales	B9 Sales	v002	00h01m17s	77	97
B9Sales [EntOrdered]	B9 Sales [EntOrdered]	v002	00h00m54s	54	
B9Sales [EntOrdered]	B9 Sales [EntOrdered]	v002	00h01m17s	77	131
B9Sales [PartDense]	B9 Sales [PartDense]	v002	00h01m25s	85	
B9Sales [PartDense]	B9 Sales [PartDense]	v002	00h02m01s	121	206
B9Sales SingleTimeVersion [AllSparse]	B9 Sales SingleTimeVersion [AllSparse]	v001	00h02m48s	168	
B9Sales SingleTimeVersion [AllSparse]	B9 Sales SingleTimeVersion [AllSparse]	v001	00h03m52s	232	400



## Detailed Results

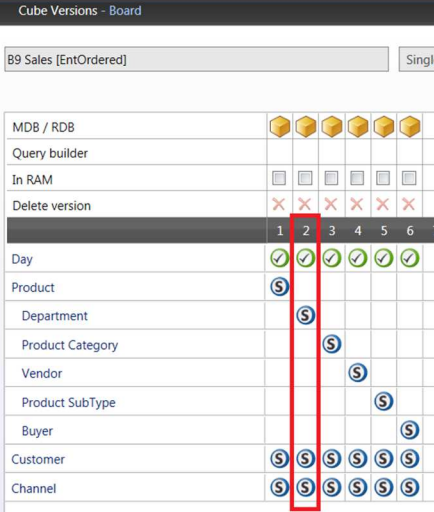
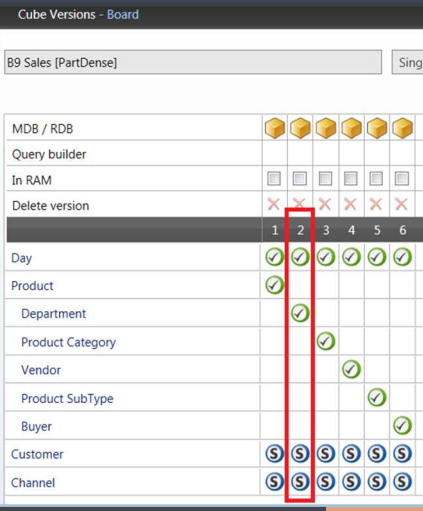
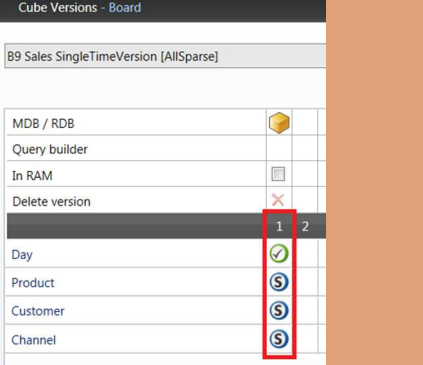
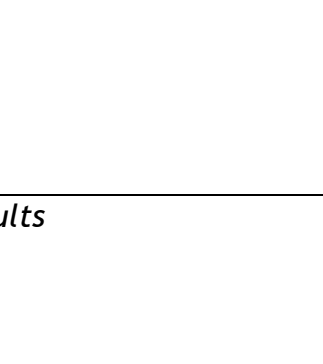
This table shows more detail on each cube, specifically you can see the dimensionality of each cube and understand how it has been built, and optimized. The red outline highlights the versions that BOARD uses in the test reports as reported in the log file.

Cube	Version	Layout Time	In Secs	Screen Total in Secs	
B9 Sales Multi Version [CustRegAgg]	v007	00h00m01s	1		
B9 Sales Multi Version [CustRegAgg]	v008	00h00m01s	1	2	
B9 Sales Multi Version [ProdDeptAgg]	v007	00h00m07s	7		
B9 Sales Multi Version [ProdDeptAgg]	v008	00h00m09s	9	16	
Sales	v011	00h00m14s	14		
Sales	v012	00h00m06s	6	20	



Cube	Version	Layout Time	In Secs	Screen Total in Secs																																																																																															
B9 Sales SingleTimeVersion [CustRegAgg]	v002	00h00m09s	9		<div>Cube Versions - Board</div> <div>B9 Sales SingleTimeVersion [CustRegAgg]</div> <table><tr><td>MDB / RDB</td><td></td><td></td></tr><tr><td>Query builder</td><td></td><td></td></tr><tr><td>In RAM</td><td></td><td></td></tr><tr><td>Delete version</td><td></td><td></td></tr><tr><td></td><td>1</td><td>2</td></tr><tr><td>Day</td><td></td><td></td></tr><tr><td>Product</td><td></td><td></td></tr><tr><td>Customer</td><td></td><td></td></tr><tr><td>Region</td><td></td><td></td></tr><tr><td>Channel</td><td></td><td></td></tr></table>	MDB / RDB			Query builder			In RAM			Delete version				1	2	Day			Product			Customer			Region			Channel																																																																		
MDB / RDB																																																																																																			
Query builder																																																																																																			
In RAM																																																																																																			
Delete version																																																																																																			
	1	2																																																																																																	
Day																																																																																																			
Product																																																																																																			
Customer																																																																																																			
Region																																																																																																			
Channel																																																																																																			
B9 Sales SingleTimeVersion [CustRegAgg]	v002	00h00m13s	13	22																																																																																															
B9 Sales MultiTimeVersion [AllSparse]	v003	00h00m21s	21		<div>Cube Versions - Board</div> <div>B9 Sales MultiTimeVersion [AllSparse]</div> <table><tr><td>MDB / RDB</td><td></td><td></td><td></td><td></td></tr><tr><td>Query builder</td><td></td><td></td><td></td><td></td></tr><tr><td>In RAM</td><td></td><td></td><td></td><td></td></tr><tr><td>Delete version</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>Day</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Week</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Month</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Quarter</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Year</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Product</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Customer</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Channel</td><td></td><td></td><td></td><td></td><td></td></tr></table>	MDB / RDB					Query builder					In RAM					Delete version						1	2	3	4	5	Day						Week						Month						Quarter						Year						Product						Customer						Channel																									
MDB / RDB																																																																																																			
Query builder																																																																																																			
In RAM																																																																																																			
Delete version																																																																																																			
	1	2	3	4	5																																																																																														
Day																																																																																																			
Week																																																																																																			
Month																																																																																																			
Quarter																																																																																																			
Year																																																																																																			
Product																																																																																																			
Customer																																																																																																			
Channel																																																																																																			
B9 Sales MultiTimeVersion [AllSparse]	v004	00h00m29s	29	50																																																																																															
B9 Sales	v002	00h00m20s	20		<div>Cube Versions - Board</div> <div>B9 Sales</div> <table><tr><td>MDB / RDB</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Query builder</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>In RAM</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Delete version</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>Day</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Product</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Department</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Product Category</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Vendor</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Product SubType</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Buyer</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Customer</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>Channel</td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	MDB / RDB						Query builder						In RAM						Delete version							1	2	3	4	5	6	Day							Product							Department							Product Category							Vendor							Product SubType							Buyer							Customer							Channel						
MDB / RDB																																																																																																			
Query builder																																																																																																			
In RAM																																																																																																			
Delete version																																																																																																			
	1	2	3	4	5	6																																																																																													
Day																																																																																																			
Product																																																																																																			
Department																																																																																																			
Product Category																																																																																																			
Vendor																																																																																																			
Product SubType																																																																																																			
Buyer																																																																																																			
Customer																																																																																																			
Channel																																																																																																			
B9 Sales	v002	00h01m17s	77	97																																																																																															
B9 Sales [EntOrdered]	v002	00h00m54s	54																																																																																																



Cube	Version	Layout Time	In Secs	Screen Total in Secs	
B9 Sales [EntOrdered]	v002	00h01m17s	77	131	
B9 Sales [PartDense]	v002	00h01m25s	85		
B9 Sales [PartDense]	v002	00h02m01s	121	206	
B9 Sales SingleTimeVersion [AllSparse]	v001	00h02m48s	168		
B9 Sales SingleTimeVersion [AllSparse]	v001	00h03m52s	232	400	



## Comparative Cube Performance

The following table compares the performance between directly comparable cubes, i.e. where the only difference is in the Time entities used.

Cube with Multiple Time Entity Versions (A)	Comparable Cube with Single Time Entity Version (B)	Time for (A)	Time for (B)	Multiplier (B/A)
B9 Sales Multi Version [CustRegAgg] [V007]	B9 Sales SingleTimeVersion [CustRegAgg] [V002]	1	9	9
B9 Sales Multi Version [CustRegAgg] [V008]	B9 Sales SingleTimeVersion [CustRegAgg] [V002]	1	13	13
B9 Sales Multi Version [CustRegAgg] COMPOSITE	B9 Sales SingleTimeVersion [CustRegAgg] [V002]	2	22	11
B9 Sales Multi Version [ProdDeptAgg] [V007]	B9 Sales [EntOrdered] [V002]	7	54	8
B9 Sales Multi Version [ProdDeptAgg] [V008]	B9 Sales [EntOrdered] [V002]	9	77	8.5
B9 Sales Multi Version [ProdDeptAgg] COMPOSITE	B9 Sales [EntOrdered] [V002]	16	131	8
B9 Sales MultiTimeVersion [AllSparse] [V003]	B9 Sales SingleTimeVersion [AllSparse] [V001]	21	168	8
B9 Sales MultiTimeVersion [AllSparse] [V004]	B9 Sales SingleTimeVersion [AllSparse] [V001]	29	232	8
B9 Sales MultiTimeVersion [AllSparse] [COMPOSITE]	B9 Sales SingleTimeVersion [AllSparse] [V001]	50	400	8

## Conclusion

In conclusion there is good news, and not so good.

The good news is that it works correctly. However performance vs. a like-for-like multi-time versioned cube is around 8 times slower. In reality, with cubes that are optimized, this may not be a show stopper. As with many things, you will need probably to try it out on your own database to assess whether removing time entity versions is viable. Against the performance loss, there is also the gain of losing additional versions that have to be maintained, and which usually incur a performance hit elsewhere, e.g. data loading.

In summary this is a very useful enhancement that will help many developer reduce the number of cube versions required to support end-user reporting requirements. However some caution needs to be taken to assess the viability in each individual case.

## Postscript

As a final test the dataviews for the 'best' performing cubes ('[CustRegAgg]' cubes, see table above) were amended to include a PY column and a PY YCV column. This was to ensure that a typical YCV combination used in many real reports worked correctly, and to check whether there were any performance implications. Pleasingly, all worked as they should; there was a small decrease in performance but nothing noticeable to the end user.