

## White Paper



### SQL Server 2008 BI Features

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#### Abstract

SQL Server 2008, released in August 2008 is the next generation of Microsoft SQL Server and has been enriched with a host of new features. This version of SQL Server introduced powerful capabilities -such as support for policy-based management, auditing, large-scale data ware housing, geo spatial data, data management, advanced reporting and analysis services, etc.

Business Intelligence (BI) technologies from Microsoft have continuously evolved over the past decade. With SQL Server 2008, Microsoft has further enhanced their BI offering. The key design pillars for SQL Server 2008 BI are Increased Developer Productivity, Improved Performance and Enriched End-user Experience.

This white paper explains some of the key features around Integration, Analysis and Reporting Services in SQL Server 2008. Business Analysts, DBAs, Project Managers, and BI developers are the target audience for this white paper.

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## BI Overview

Over the years, Microsoft has built an end-to-end BI platform and is now taking it to the next level. BI technologies - in the form of Data Transformation Services (DTS), Analysis Services and Reporting Services - were first seen along with SQL Server 2000. In SQL Server 2005, DTS was rewritten as SQL Server Integration Services (SSIS), which is an enterprise class Extract – Transform – Load (ETL) tool. Reporting services were further improved with SQL Server 2005 by making it an enterprise reporting platform, introducing features like ad hoc reporting, role based security, end-user sorting, direct client printing, etc. With Analysis Services, SQL Server 2005 introduced Universal Dimensional Model (UDM), cube partitioning, data mining and predictive analysis, what-if modeling, key performance indicators, etc. Business Intelligence Development Studio (BIDS) was introduced with SQL Server 2005 to give a single and integrated tool for development of SSIS, SQL Server Analysis Services (SSAS) and SQL Server Reporting Services (SSRS) objects.

Figure 1 shows available technologies and offerings from Microsoft on BI.



Figure 1: MS BI End-to-end Offering

SQL Server 2008 makes data available at any place, any time, and to any device to its customers. It provides for a more trusted, scalable and available platform. With significant advancements in key areas, SQL Server 2008 becomes a more productive, intelligent and enterprise data platform.

The new features in SQL Server 2008 are added around the following four major themes.

1. **Enterprise Data Platform:** SQL Server 2008 provides a more reliable, secure, trusted and scalable platform. It improves availability, using enhanced data mirroring, predictable query performance, data and backup compression, and many development features. Another innovative feature is Policy-based management, which enables an easier SQL Server administration.
2. **Beyond Relational:** The features in this category can handle any type of data, even those that are unstructured and non relational. New data types are introduced to handle geo spatial data, documents and image files as well. It enables the developers to design location intelligent applications and enhances the ability to handle the document management.
3. **Dynamic Development:** Using the new .NET Framework 3.5 reduces the complexity of the development with ADO.NET Entity Framework and Language Integrated Query (LINQ) to SQL. ADO.NET Entity Framework enables the developers to become more productive by directly interacting with the business entities. Developers can write synchronizing applications by using features like change tracking.
4. **Pervasive Insight:** These features further enhance the SSIS, SSAS and SSRS, making them more scalable. They enable the enterprises to integrate all the data into data warehouse more efficiently and enables real-time data analysis. It also empowers every user with actionable insights.

## Top 15 Enhancements for BI in SQL Server 2008

The following sections introduce important features in SQL Server 2008 - BI, their functionality and benefits. The features are further categorized under three core BI services in SQL Server, i.e.

- SQL Server Integration Services (SSIS)
- SQL Server Analysis Services (SSAS)
- SQL Server Reporting Services (SSRS)

The features described here mainly focus on:

- The integration of real-time data in an incremental way
- Performance improvements to make BI more scalable
- Intelligent analytics and improved reporting through powerful visualization
- New architecture and simplified deployment

This white paper also lists some of the benefits of the features.

### *Top 5 Enhancements for effective data integration, using SSIS*

The following are the top 5 enhancements that help in integrating the data more effectively, using SSIS.

1. Change Data Capture (CDC)
2. Data Profiling Task
3. SSIS Performance Improvements
  - a. Persistent Lookups
  - b. SSIS Pipeline improvements (Better Parallel Execution)
4. Merge SQL Statement
5. Enhanced Supportability

### *1. Change Data Capture (CDC)*

CDC is a generic database engine feature added in SQL Server 2008. It is useful in data integration, to incrementally load the data into the data warehouse. This enables users to get the latest information from the warehouse. CDC is enabled first at the database and then at the table level. Once enabled, it makes the changed data available in changed tables - including the schema changes. The CDC feature also provides APIs/ functions, which can be used in SSIS package to capture the changed schema and data. CDC works with the database log, asynchronously, to get the changes in the change tables. Figure 2 shows the components involved in CDC.

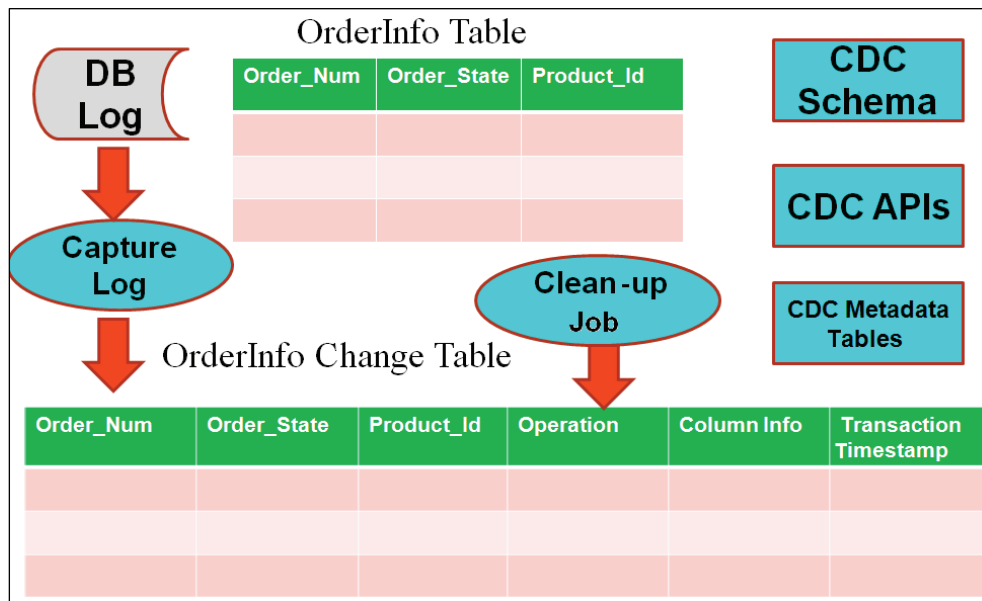


Figure 2: CDC Components

## Advantages

- Minimizes the overhead on the source Online Transaction Processing (OLTP) databases, compared to the earlier approaches
- Reduces complexity in capturing the changes
- Makes real-time data warehousing possible
- Helps in automating the task of incremental data warehouse loading, thereby improving the productivity

## What you should also know

- Plan for more database space due to data redundancy caused by CDC feature
- Additional maintenance efforts, for the changed tables and the maintenance of jobs created by CDC, for capturing and purging the data
- Cannot use Truncate Option on the table for which CDC is enabled

## 2. Data Profiling Task

Data profiling is statistical analysis and validation of data. It helps in analyzing the data quality and identifies issues like null, duplicate, missing values, etc. Data profiling is necessary in most BI applications as the business uses the warehouse data for data mining. SSIS provides out-of-box transformation for these kinds of tasks, which can be embedded in the ETL tool. The data profiling task can be easily configured and used with script task to detect the data quality issues in the source data.

## Advantages

- Effective analysis to identify source data quality issues
- Minimizes the efforts in preventing the data quality issues as compared to earlier approaches
- Complex logic in erroneous data handling is partially taken off from ETL

## What you should also know

- Works with SQL Server 2000 and later versions only
- Does not support third party databases and file-based data sources

### 3. SSIS Performance Improvements

There are two key enhancements made in SSIS 2008 for performance improvements, which contribute even to scalability.

#### a. Persistent Lookups

The lookup component in this version of SSIS will scale to large data sets compared to the earlier version, and hence improves the performance. SSIS 2008 has Cache Connection manager, which can be shared across the data flow tasks of a package. The cache can be populated in one data flow task, and be used in subsequent data flow tasks. It can also be persisted to a file and can be reused. The cache can also be rebuilt with new rows.

#### Advantages

- Explicit control over sharing and the lifetime of the lookup data
- Improved performance as the same cache can be used across the package

#### b. SSIS Pipeline improvements (Better Parallel Execution)

Package execution in SSIS 2008 adopts a parallel execution mechanism. The parallel execution is handled by SQL Server internally. Until the earlier version, as per the architecture, only one thread was handling the execution of all the tasks. It has a new thread scheduler, which will process multiple tasks in parallel and improves performance.

#### Advantages

- Increased Performance
- Better runtime stability
- Benefits for the multicast and conditional split transformations execution

### 4. Merge SQL Statement

Most of the data warehouse scenarios include a requirement like load the data into warehouse if it doesn't exist; if the data exist, then update the latest data into the warehouse based on certain key fields. SQL Server 2008 has a TSQL enhancement, called "UPSERT", which combines action of the multiple DML statements. This is used in scenarios like: When the data does not exist, "INSERT" it and when the data exists, "UPDATE" it. The entire job is done in single statement, reducing (IO) , and hence can be used in integration of large data in a data ware housing scenario.

#### Advantages

- Reduces the IO in large data integrations scenario
- Handles the complex scenarios in single statement, thereby reducing complexity
- Reduces round trips to SQL Server in large data integration scenarios

### 5. Enhanced Supportability

This is to improve the productivity of the developer and give more debugging capabilities. Imagine a scenario where you have a package that is in a deadlocked or hung state. It requires an expert to debug the problem. SQL Server 2008 has a feature called "Super Dump" that helps in such scenarios. Dumps can be created on specific errors. The dump can be either a text or a binary file. The binary file can be opened using the "WinDbg" utility and you can look at the exact call stacks, the function where the error is occurring, the variable values, etc.

#### Advantages

- Improves the debugging capability on the package, and hence the productivity
- Can be used to find out the issues with the running packages

## Current Limitations

- Can be used only with *dtexec* utility and in BIDS. Cannot be used with *dtexecul* utility

## Top 5 Enhancements for effective data analysis using SSAS

This section discusses the top five enhancements done in SSAS with SQL Server 2008. These enhancements help to improve the analysis of your data, improve the MDX query performance and make your OLAP environment more robust.

1. Attribute relationship design
2. MOLAP Write back
3. Block Computation
4. Star Join query optimization
5. Partitioned Table Parallelism

### 1. Attribute Relationship Design

This is an enhanced feature in SSAS 2008. The way attribute relationship functionality was exposed in SSAS 2005, was not doing justice to the importance of defining the relationship between the attributes. So a new user interface for the attribute relationships has been added in SSAS 2008, as shown in Figure 3. It is highly recommended to define attribute relationships, as they play a very vital role in performance.

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*Example: Consider a Geography dimension with Country, State, City, Postal Code and Geography Key as the attributes. By default, SSAS engine creates a relationship from primary key to all the attributes. However, sometimes, we need to establish the relationship between other attributes as well.*

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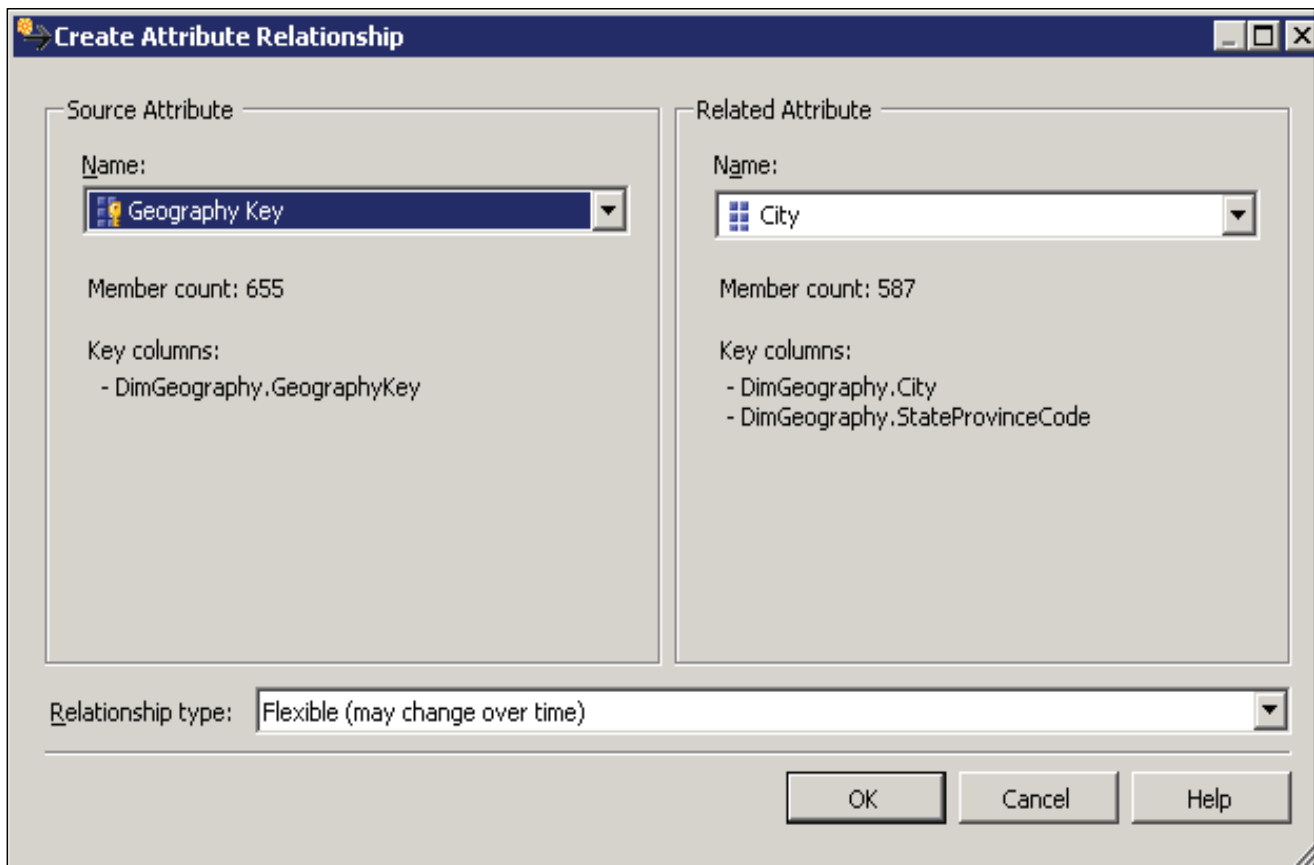


Figure 3: Attribute Relationship

## Advantages

- Improves the query performance by reusing the pre-calculated results
- Type of relationship can be defined simultaneously

## What you should also know

- All the redundant attribute relationships have to be removed manually

## 2. MOLAP Write back

SQL Server 2008 includes a new MOLAP-enabled write-back feature that removes the need to query ROLAP partitions. The new write-back technique means that fewer round trips are needed between the client and the OLAP partition to complete the analytical modeling. That is, write-back occurs faster in SQL Server 2008, so that when changes are made to a model, they are then written back to the database. This, in turn, refreshes the cube in a timelier manner. Users get better and faster write-back scenarios, without giving up any of the advantages of a traditional OLAP engine, for aggregating data.

## Advantages

- Fewer round trips between OLAP partition and client
- Change made to a model is written back to database quickly
- No need to query ROLAP partitions, and no need to trigger an extra EXECUTESQL event
- A significant performance gain is achieved compared to ROLAP partition write-back
- A MOLAP write-back partition also improves cell write-back performance, since server internally sends the queries to compute write-back deltas

## What you should also know

- A MOLAP write-back transaction commit can be a little slower, since the server must update the MOLAP partition data in addition to write-back table, but this is insignificant compared with other performance gains

## 3. Block computation

Block computations provide big performance gains by eliminating unnecessary aggregation calculations, such as NULL values in an aggregation. Cube calculation times are likewise much faster, so users can increase the depth of their hierarchies, perform more complex calculations, or simply accomplish the same work as before, more quickly.

Consider a MDX query:

```
WITH MEMBER Measures.Contribution AS  
    'Measures.Sales/(Measures.Sales,Product.CurrentMember.Parent)'  
SELECT Product.[Product Family].Members ON COLUMNS,  
    Customer.Country.Members ON ROWS  
FROM Sales
```

Let's see how this query is evaluated in SSAS 2005

- First the axes are populated, X axis with Products and Y axis with countries.

	Drink	Food	Non-Consumable
Canada			
Mexico			
USA			

- Then cells are populated with Sales data (assuming null values for Canada and Mexico)

	Drink	Food	Non-Consumable
Canada	Null	Null	Null
Mexico	Null	Null	Null
USA	\$24597	\$191940	\$50236

- Then total sales is calculated for all the products

	All Products
Canada	Null
Mexico	Null
USA	\$266773

- Then Measures contribution is calculated by dividing the individual sales value to the total sales value. While doing this, SSAS engine is doing Null/ Null operation 6 times, 3 each for Canada and Mexico.
- Then final result is displayed

	Drink	Food	Non-Consumable
Canada	Null	Null	Null
Mexico	Null	Null	Null
USA	9.22%	71.95%	18.83%

As seen above, SSAS engine is computing Null vales and doing division when the numerator is null. This can be avoided using Block computation in SSAS 2008. By using this, only non null values are retrieved from storage engine. Perform the computation for all the not null values and the rest is Null.

### Advantages

- Only Non-Null values are fetched from storage engine
- No time is wasted in evaluating Null cells
- A fair amount of effort is saved by avoiding Null calculations

### 4. Star Join Query Optimization

SQL Server by default has a mechanism to choose efficient query plan. It helps in improving the performance of queries when dealing with millions of rows. To improve the star schema joins, SQL Server uses a new mechanism known as bitmap filter (also known as Bloom Filters). Bitmap filter is a mechanism to join only the qualifying rows from second table. This significantly reduces the amount of data to be processed. SQL Server 2008 allows a bitmap filter to be dynamically applied during the query plan generation. When the bitmap filter is applied, non-qualifying rows in fact table gets eliminated and hence the query is faster. Star join query optimizations reduce query response time by recognizing data warehouse join patterns.

### Advantages

- Significant performance improvement for star join queries
- Considerable amount of CPU time is saved by eliminating non qualifying fact table rows
- Bitmap filters almost eliminate all the rows that would be eliminated later by joins
- Automatically applies to all the queries following star join pattern, without doing any change in application.



## 5. Partitioned Table Parallelism (PTP)

Data warehouse applications contain large amounts of historical data in fact tables and these data are partitioned by time. In SQL Server 2005, queries that touch more than one partition use one thread (and thus one processor core) per partition, which limits the performance of queries that involve partitioned tables. Partitioned Table Parallelism (PTP) improves the performance of parallel query plans against partitioned tables by better utilizing the processing power of the existing hardware.

The following figure represents PTP mechanism in a data warehouse scenario:

### Partitioned Fact Table

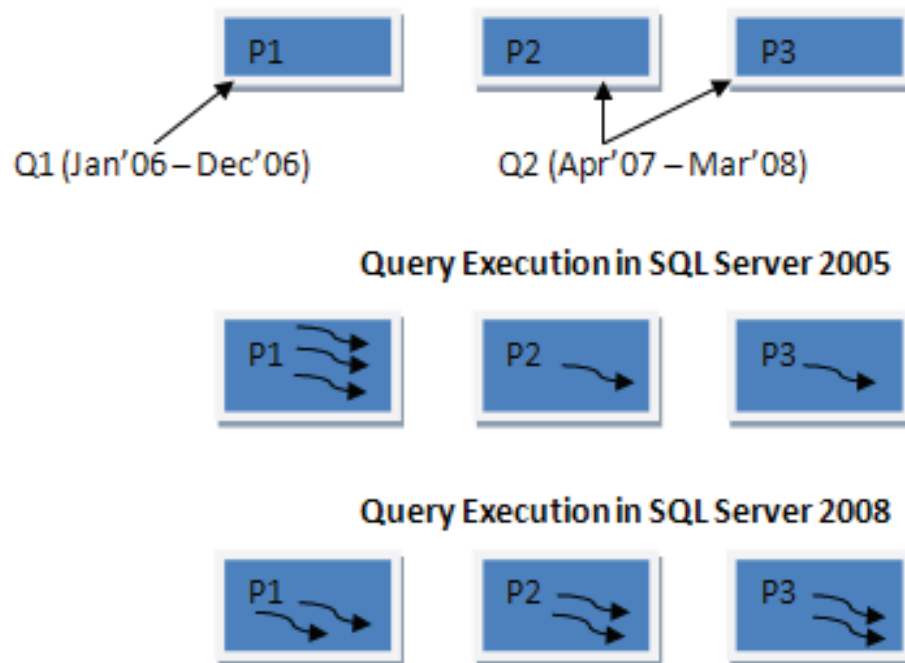


Figure 4: Fact Table

Suppose we have a fact table with three partitions, and each partition is responsible for containing one year sales data (Jan-Dec). A query against the fact table can either hit one partition, or more than one. Let's say we have three partitions for year 2006 (P1), 2007 (P2) and 2008 (P3). Assume a query Q1 that needs sales information from Jan'2006 to Dec'2006 and query Q2 needs sales information from April'2007 to Mar'2008. So Q1 will hit only partition P1, while Q2 needs to hit P2 and P3, as shown in the above figure.

Let's see the execution of Q1 and Q2 in SQL Server 2005 and SQL Server 2008. In case of SQL Server 2005, all threads can be allocated to a single partition query. Therefore, execution of Q1 results in a parallel plan, involving P1 that is processed by all available threads. But, in case of Q2 (multi-partitioned query), the executor assigns only a single thread each to partition P2 and P3, irrespective of additional threads available. So a lot of CPU power remains unutilized and Q2 executes much slower than Q1. In case of SQL Server 2008, there is a better utilization of available hardware. Q1 will be executed in the same way as it was getting executed in SQL Server 2005, but execution of Q2 results in a parallel plan where the executor will assign all the available threads to P2 and P3 in round-robin style. Thus, CPU remains fully utilized and performance of Q1 and Q2 are comparable.

### Advantages

- Improved performance of parallel query plans against partitioned tables
- Better utilization of available hardware
- A new round robin thread allocation mechanism helps in performance boost.

## Top 5 Enhancements for effective delivery of the data, using SSRS

This section discusses the top five enhancements done in SSRS with SQL Server 2008.

These enhancements help to improve the delivery and visualization of the data. SSRS 2008 also simplifies the deployment and configuration.

1. New Architecture (Elimination of IIS)
2. New Report Designer
3. Powerful visualization
4. New tablix control
5. Improved rendering

### 1. New Architecture (Elimination of IIS)

The biggest change done to the SSRS architecture, in SQL Server 2008, is to eliminate the Internet Information Services (IIS). Look at the new architecture in Figure 5. This makes the configuration of the reporting services easier than that in SQL Server 2005. IIS is designed for static and dynamic HTML pages. It was difficult to do the resource management for large reports with IIS. Instead, now in the new architecture, SQLOS itself handles this resource management for the reports. The elimination of IIS also helps in eliminating the deployment obstacles like policy, and skill set of the resource who would be working on deployment.

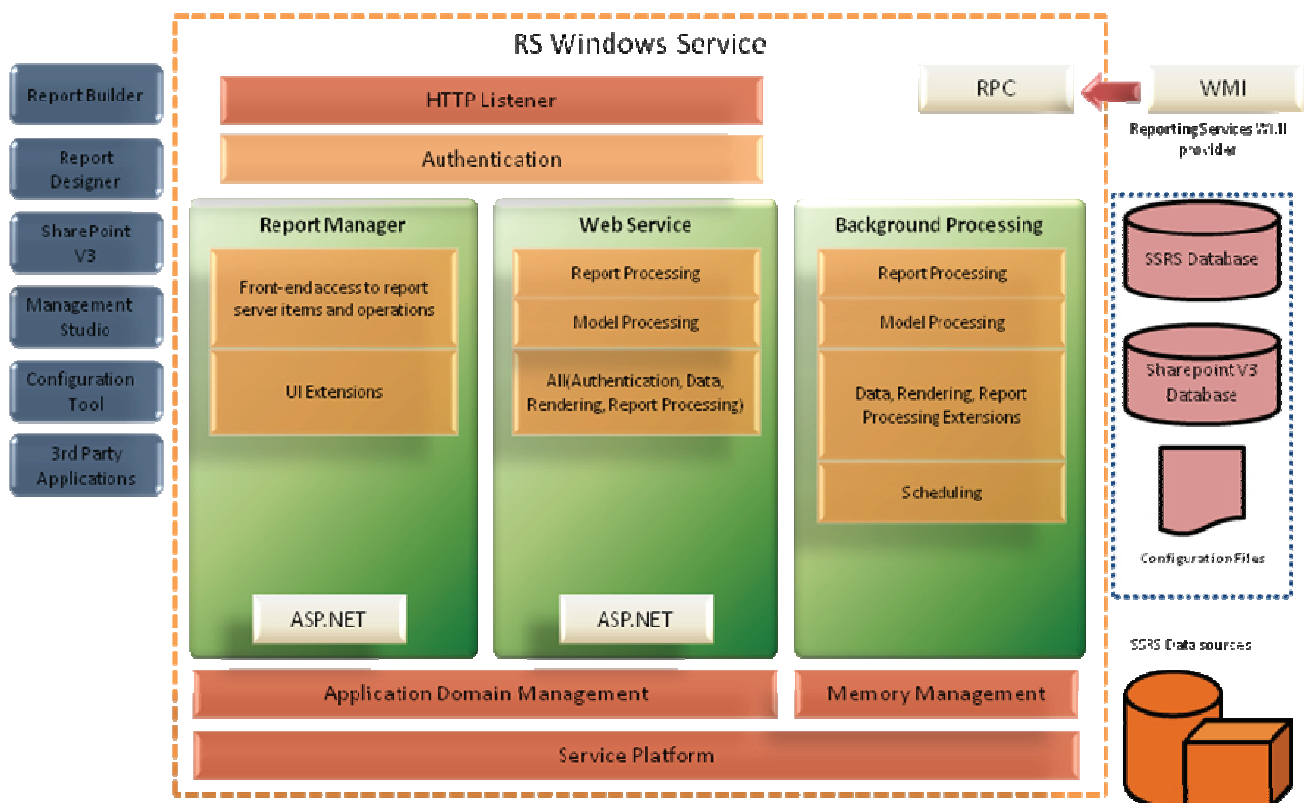


Figure 5: SSRS Architecture

Memory management in SQL Server 2008 is redesigned to enable reporting server to handle report generation smoothly, and eliminate the “Out-Of-Memory” exception that was one of the main problem with SQL Server 2005. The memory management in SQL Server 2008 is handled by SQL Server memory broker. It has capability to assess the memory pressure on the reporting server. It allocates RAM memory to the processes and makes use of file system cache wherever required. The SQL Server memory broker categorizes the Reporting server state in three levels, and adopts the memory allocation strategy as discussed below:

Reporting Server State	Memory Allocation Strategy
High Memory Pressure	<ol style="list-style-type: none"> <li>1. Current reports execution continues with a slower execution</li> <li>2. New report generation requests are denied</li> <li>3. Memory allocation is reduced to ensure that the memory pressure doesn't increase</li> <li>4. Memory swaps to disk starts to create room in memory for processing</li> </ol>
Medium Memory Pressure	<ol style="list-style-type: none"> <li>1. Current requests execution continues in the same pace</li> <li>2. New requests might be accepted</li> <li>3. Memory allocation reduces for applications</li> <li>4. Background processing reduces</li> </ol>
Low Memory Pressure	<ol style="list-style-type: none"> <li>1. Current requests execution continues</li> <li>2. New requests are accepted</li> <li>3. Background processing will be given low priority</li> </ol>

Rendering in SQL Server 2005 was not optimally designed, which also has problems with pagination and inconsistent images, based on client resolution. This has been addressed in SQL Server 2008 by redesigning the rendering architecture and its extensions. SQL Server 2008 also included MS-Word as its new rendering format of reports.

At a high level, SSRS reporting engine enhancements can be detailed as follows:

- Processing
  - On demand processing redesigned for scalability - When large reports were running in SQL Server 2005, the reporting services engine used to consume most of the memory, ending up with Out-Of-Memory exception
  - Response time across pages is made constant
  - Implemented Hierarchical Cursor-based object model
- Rendering
  - Rendering architecture is newly designed
  - Extensions for rendering are re-written

## 2. New Report Designer

An enhanced Report Designer is optimized for creating extensive reports, enabling organizations to accommodate all reporting needs. Unique layout capabilities allow the design of reports of any structure, while new visualization enhancements further enrich the user experience. This also enables the business users to edit or update existing reports within an environment optimized for Microsoft Office, regardless of where the report was initially designed.

Figure 6 shows the new report designer.

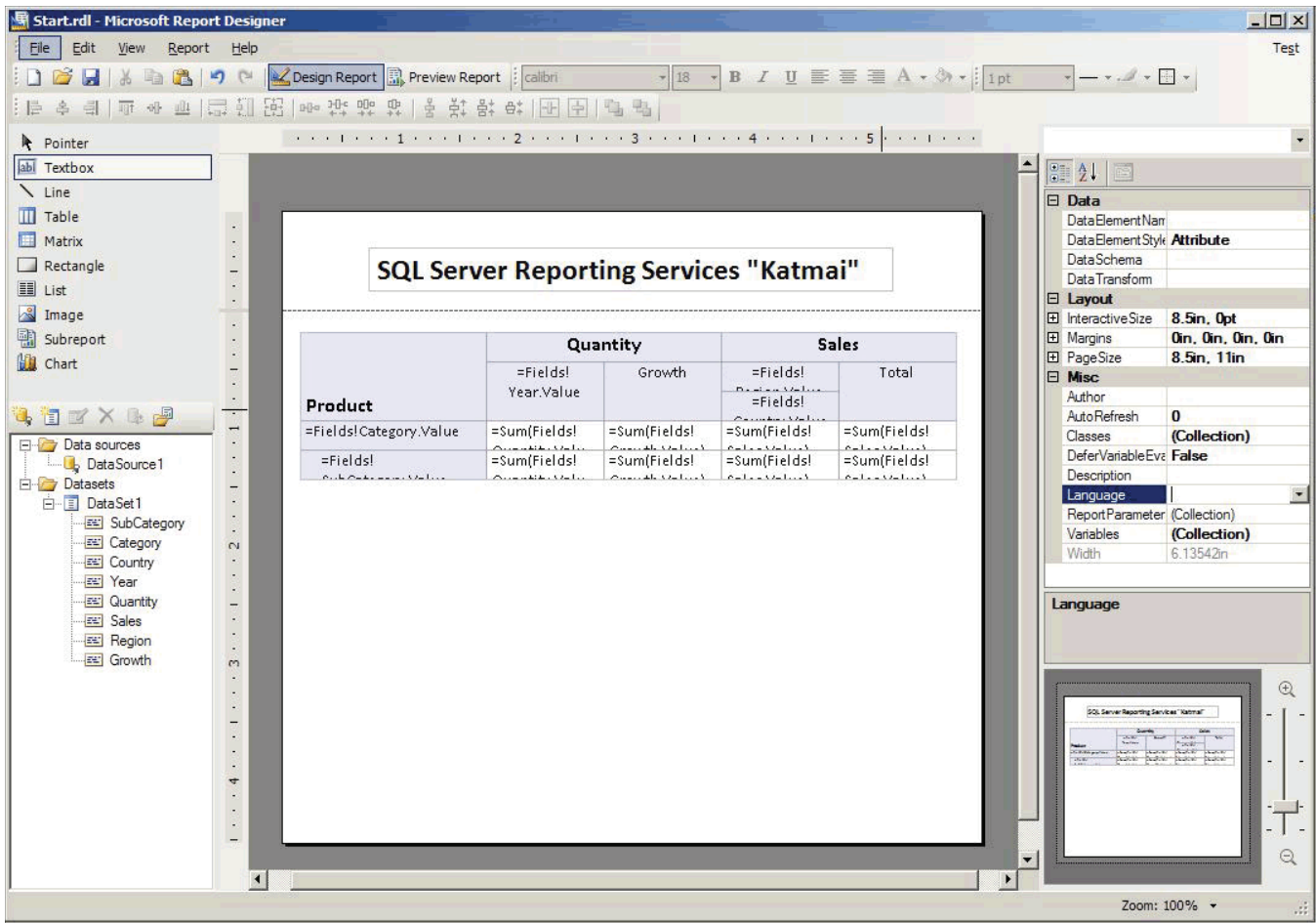


Figure 6: New Report Designer

### 3. Powerful visualization

SQL Server 2008 extends the visual components available within reports. Visualization tools - such as maps, gauges, and charts make reports more accessible and understandable. Microsoft has integrated “Dundas Chart” with SSRS in SQL Server 2008. Figure 7 below shows how a powerful visualization is achieved, using SSRS 2008.

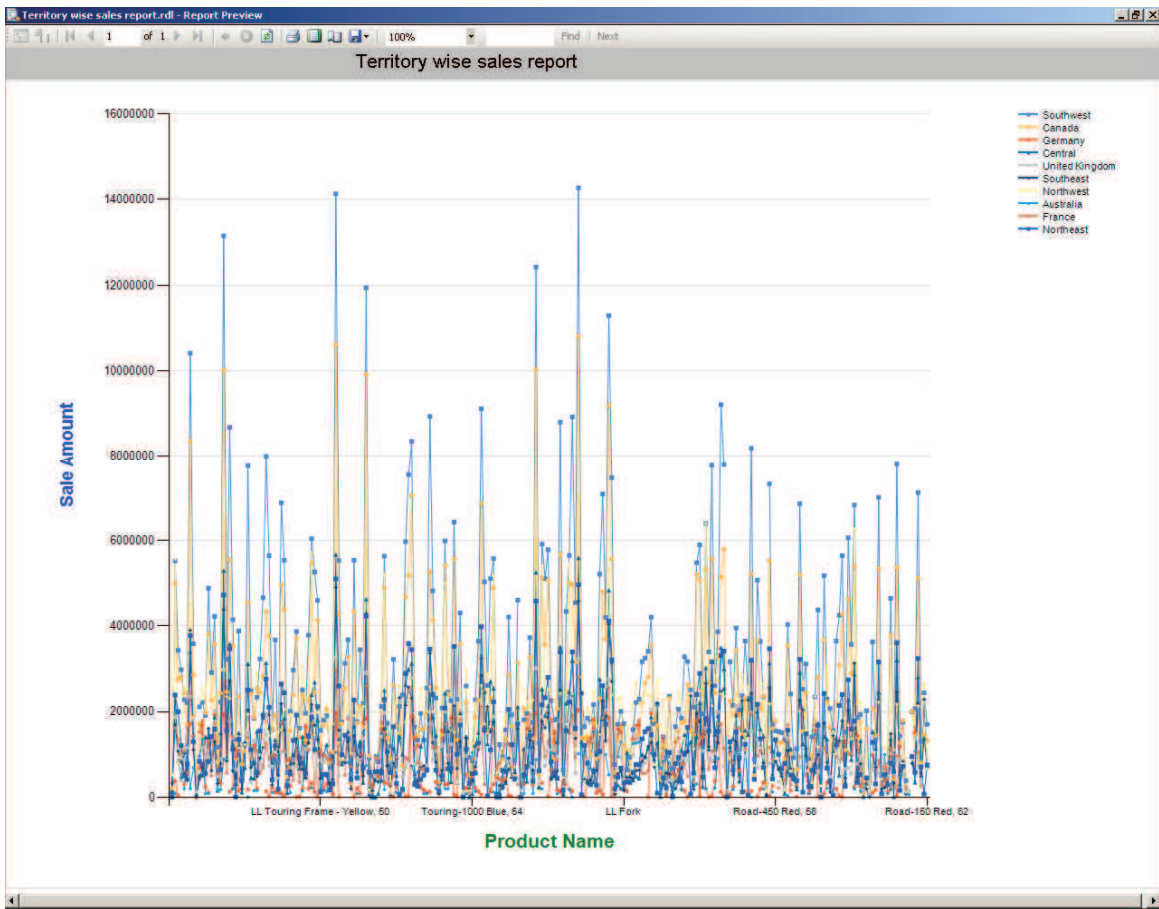


Figure 7: SSRS Chart control

#### 4. New Tablix control

This is a new feature introduced in SQL Server 2008. Assume a scenario where the business analyst wants to compare last 3 years sales, along with the product-wise sales to make certain key decisions. As both are two discrete groupings, those would be produced as different set of reports.

		2005	2006
WA	Seattle	50	60
	Spokane	30	40
OR	Portland	40	50
	Eugene	20	30

		Tyres	Tubes
WA	Seattle	20	30
	Spokane	10	20
OR	Portland	10	10
	Eugene	25	5

Tablix control enables to create the report as follows:

		2005	2006	Tyres	Tubes
WA	Seattle	50	60	20	30
	Spokane	30	40	10	20
OR	Portland	40	50	10	10
	Eugene	20	30	25	5

Data analysis will become easier with the above representation of data, which is possible by using the tablix control. Figure 8 below shows the amount of sales made in each year, in each territory, shown side by side. This makes data analyst/management decision making process easy.

Product Name	2001	2002	2003	Southwest	Canada	Germany	Central	United Kingdom	Southeast
Mountain Bike Socks, L	\$ 1,299,982.97			\$ 107,678.28	\$ 205,909.21		\$ 132,474.41		\$
Mountain 200 Silver, 42	\$ 19,488,562.80	\$ 6,555,107.12	\$ 467,185.04	\$ 5,519,034.11	\$ 4,988,753.34	\$ 380,513.36	\$ 2,394,123.56	\$ 1,871,162.36	\$ 1,
HL Road Frame - Black, 44	\$ 9,439,962.13	\$ 3,654,970.00	\$ 36,500.58	\$ 3,429,868.28	\$ 2,743,126.23	\$ 40,534.60	\$ 853,912.50	\$ 826,883.38	\$ 1,
Men's Sports Shorts, S	\$ 7,400,675.49	\$ 3,262,492.04		\$ 2,979,980.45	\$ 2,809,033.23		\$ 457,045.54	\$ 393,690.71	\$
HL Mountain Seat/Saddle	\$ 7,828,953.97	\$ 3,484,069.81	\$ 495,892.06	\$ 2,273,492.64	\$ 2,432,375.50	\$ 301,355.71	\$ 1,062,086.44	\$ 873,330.77	\$
Front Derailleur	\$ 7,564,077.96	\$ 3,372,533.90	\$ 1,708,754.42	\$ 2,211,131.95	\$ 1,704,965.38	\$ 569,101.92	\$ 449,248.19	\$ 1,162,267.71	\$
Long-Sleeve Logo Jersey, XL	\$ 31,109,508.89	\$ 8,126,672.84	\$ 1,815,069.52	\$ 10,412,890.22	\$ 8,363,319.90	\$ 1,711,303.77	\$ 3,401,190.71	\$ 2,351,077.62	\$ 3,
Short-Sleeve Classic Jersey, S	\$ 11,721,611.93	\$ 3,818,046.63	\$ 2,471,666.47	\$ 3,582,787.70	\$ 2,861,051.72	\$ 1,876,033.12	\$ 1,458,080.79	\$ 1,822,493.30	\$ 1,
LL Road Seat/Saddle	\$ 207,900.99	\$ 22.18			\$ 112.14		\$ 77,266.22	\$ 129,003.51	
HL Crankset	\$ 7,127,870.68	\$ 3,316,439.83	\$ 1,478,800.50	\$ 2,110,530.18	\$ 1,717,327.68	\$ 677,013.25	\$ 513,254.01	\$ 921,952.10	\$
Touring 2000 Blue, 54	\$ 7,469,629.08	\$ 3,850,931.51	\$ 2,782,774.45	\$ 2,213,044.74	\$ 1,385,111.02	\$ 1,686,842.50	\$ 513,751.91	\$ 1,152,997.28	\$
Mountain 500 Silver, 42	\$ 7,307,208.24	\$ 2,880,898.79	\$ 337,926.84	\$ 1,908,023.97	\$ 1,973,804.23	\$ 253,100.95	\$ 1,405,303.09	\$ 930,350.23	\$
HL Mountain Frame - Black, 38	\$ 13,952,676.99	\$ 4,554,195.30	\$ 203,451.35	\$ 4,881,635.37	\$ 3,811,609.49	\$ 111,174.65	\$ 1,399,307.74	\$ 925,455.48	\$ 1,
ML Mountain Frame - Black, 44	\$ 8,628,015.98	\$ 2,818,946.26		\$ 2,911,348.45	\$ 2,263,076.67		\$ 848,164.19	\$ 806,666.90	\$
Short-Sleeve Classic Jersey, L	\$ 13,929,335.56	\$ 4,838,201.13	\$ 2,942,807.11	\$ 4,218,817.20	\$ 3,577,617.85	\$ 1,930,070.99	\$ 1,871,687.92	\$ 2,023,040.15	\$ 1,
HL Touring Frame - Blue, 50	\$ 2,786,020.81	\$ 1,803,347.77	\$ 626,703.25	\$ 1,173,352.64	\$ 845,518.72	\$ 550,546.92	\$ 160,974.92	\$ 490,381.02	\$
ML Mountain Frame-W - Silver, 42	\$ 8,963,220.86	\$ 3,585,484.42	\$ 503,891.69	\$ 2,220,519.18	\$ 2,428,384.67	\$ 326,789.10	\$ 1,498,110.90	\$ 894,424.80	\$
Sport-100 Helmet, Blue	\$ 39,800,795.42	\$ 10,294,852.22	\$ 2,724,171.85	\$ 13,151,819.79	\$ 10,012,730.25	\$ 1,933,804.15	\$ 5,290,038.66	\$ 2,976,226.86	\$ 4,
Mountain 300 Black, 44	\$ 9,814,727.26	\$ 2,983,949.99		\$ 3,220,882.14	\$ 2,459,733.06		\$ 935,390.62	\$ 865,306.15	\$
Road 550-W Yellow, 38	\$ 22,680,627.88	\$ 7,249,736.17	\$ 126,611.42	\$ 8,680,551.09	\$ 5,540,033.21	\$ 126,611.42	\$ 3,583,661.17	\$ 1,794,745.70	\$ 2,
LL Mountain Handlebars	\$ 11,608,167.09	\$ 5,156,265.41	\$ 399,774.17	\$ 4,144,046.91	\$ 3,537,261.67	\$ 205,237.82	\$ 1,238,137.89	\$ 1,386,349.00	\$
LL Touring Frame - Blue, 54	\$ 3,836,194.38	\$ 2,180,440.60	\$ 1,518,175.62	\$ 1,357,300.89	\$ 895,254.86	\$ 1,122,043.22	\$ 320,379.52	\$ 641,569.38	\$
Road 350-W Yellow, 40	\$ 10,390,762.21	\$ 3,255,083.55	\$ 147,373.98	\$ 3,880,897.73	\$ 2,354,574.30	\$ 147,373.98	\$ 1,502,338.34	\$ 1,161,722.46	\$ 1,
ML Road Frame - Red, 52	\$ 1,918,562.69			\$ 437,772.33	\$ 773,094.40		\$ 117,809.08		\$
HL Mountain Frame - Black, 48	\$ 5,507,176.78			\$ 1,230,045.64	\$ 1,087,735.24		\$ 688,295.93		\$ 1,
Road 250 Black, 52	\$ 18,161,844.06	\$ 6,616,982.24	\$ 181,923.44	\$ 7,741,952.24	\$ 4,541,875.57	\$ 179,979.51	\$ 3,118,610.03	\$ 1,506,898.14	\$ 2,
Men's Sports Shorts, L	\$ 6,368,601.83	\$ 2,933,045.03		\$ 2,479,608.75	\$ 2,413,447.67		\$ 457,609.20	\$ 341,295.09	\$
Patch Kit/B Patches	\$ 6,679,352.54	\$ 2,597,433.55	\$ 1,269,161.68	\$ 1,841,772.65	\$ 1,868,103.23	\$ 1,212,989.29	\$ 443,573.11	\$ 1,315,189.33	\$
LL Mountain Frame - Silver, 42	\$ 8,833,359.70	\$ 3,636,988.67	\$ 361,592.50	\$ 2,332,276.83	\$ 2,533,680.11	\$ 205,833.61	\$ 1,538,805.59	\$ 1,003,057.02	\$
Mountain 300 Black, 40	\$ 9,814,562.23	\$ 3,029,105.55		\$ 3,227,298.97	\$ 2,432,849.43		\$ 1,077,974.11	\$ 814,248.32	\$
Road 250 Red, 52	\$ 10,969,453.89	\$ 4,103,330.23		\$ 4,656,170.56	\$ 2,827,575.96		\$ 1,864,553.73	\$ 678,674.39	\$ 1,
Road 550-W Yellow, 42	\$ 18,423,698.16	\$ 6,404,743.06	\$ 136,410.33	\$ 8,004,521.19	\$ 4,338,206.53	\$ 138,679.64	\$ 3,136,134.46	\$ 1,466,550.01	\$ 1,
LL Road Rear Wheel	\$ 13,683,638.89	\$ 4,419,274.73	\$ 13,523.50	\$ 5,637,842.14	\$ 3,767,475.09	\$ 13,523.50	\$ 1,943,658.72	\$ 721,273.83	\$ 1,
ML Mountain Seat/Saddle	\$ 5,490,658.15	\$ 2,605,204.22	\$ 336,400.54	\$ 1,581,423.51	\$ 1,591,479.27	\$ 226,890.08	\$ 783,415.04	\$ 721,684.03	\$
Road 750 Black, 58	\$ 9,058,580.10	\$ 3,024,109.98	\$ 117,874.46	\$ 3,675,048.49	\$ 1,913,090.79	\$ 117,874.46	\$ 1,341,869.66	\$ 973,423.06	\$
Mountain 500 Black, 52	\$ 4,556,552.25	\$ 1,200,826.70	\$ 132,044.32	\$ 805,199.83	\$ 1,094,362.57	\$ 132,044.32	\$ 1,088,611.59	\$ 452,892.88	\$
ML Road Frame-W - Yellow, 48	\$ 16,911,876.57	\$ 5,870,139.36	\$ 81,878.10	\$ 6,871,426.21	\$ 4,961,043.36	\$ 84,841.20	\$ 1,750,238.26	\$ 1,055,216.93	\$ 2,

Figure 8: Tablix control

## 5. New / Improved rendering

SQL Server 2008 introduced MS-Word to its rendering extensions. This enables users to export the SSRS report into MS Word 2000 or later. Once the report is rendered into MS-Word, it creates a word document on top of which the user can modify the report to make it look like a word document itself. This rendering would be useful to those who would like to send documents to their customers. Extension for the file generated by this renderer will be “.doc/docx”.

Figure 9 shows a sample screenshot of the report, which is rendered into a word document. As the report has more number of columns, we need to look at the report in “Web Layout” view to get the full view of the report in one shot.



Product Name	Southwest	Canada	Germany	Central	United Kingdom	Southeast	Northwest	Australia	France	Northeast
Mountain Bike Socks, L	\$ 107,678.28	\$ 205,909.21		\$ 132,474.41		\$ 330,225.52	\$ 523,688.74			\$ 6.82
Mountain-200 Silver, 42	\$ 5,519,034.11	\$ 4,988,753.34	\$ 380,513.36	\$ 2,394,123.56	\$ 1,871,162.36	\$ 1,698,018.37	\$ 5,562,984.17	\$ 86,671.68	\$ 1,623,041.58	\$ 2,386,552.43
HL Road Frame - Black, 44	\$ 3,429,868.28	\$ 2,743,128.23	\$ 40,534.60	\$ 853,912.50	\$ 826,883.38	\$ 1,075,928.56	\$ 807,142.69		\$ 1,353,679.46	\$ 1,999,355.02
Men's Sports Shorts, S	\$ 2,979,980.45	\$ 2,809,033.23		\$ 457,045.54	\$ 393,690.71	\$ 829,193.72	\$ 1,000,227.56		\$ 1,011,530.27	\$ 1,202,466.04
HL Mountain Seat/Saddle	\$ 2,273,492.64	\$ 2,432,375.50	\$ 301,355.71	\$ 1,062,086.44	\$ 873,330.77	\$ 549,035.19	\$ 2,551,054.06	\$ 194,536.35	\$ 1,072,153.29	\$ 499,495.90
Front Derailleur	\$ 2,211,131.95	\$ 1,704,965.36	\$ 569,101.92	\$ 449,248.19	\$ 1,162,267.71	\$ 395,115.95	\$ 2,527,646.68	\$ 1,223,666.82	\$ 1,624,306.52	\$ 777,915.16
Long-Sleeve Logo Jersey, XL	\$ 10,412,890.22	\$ 8,363,319.90	\$ 1,711,303.77	\$ 3,401,190.71	\$ 2,351,077.62	\$ 3,899,597.96	\$ 4,517,057.67	\$ 202,170.82	\$ 2,421,297.75	\$ 3,771,344.82
Short-Sleeve Classic Jersey, S	\$ 3,582,787.70	\$ 2,861,051.72	\$ 1,876,033.12	\$ 1,458,080.79	\$ 1,822,493.30	\$ 1,109,918.88	\$ 1,868,292.04	\$ 694,038.43	\$ 1,438,245.50	\$ 1,300,383.55
LL Road Seat/Saddle		\$ 112.14		\$ 77,266.22	\$ 129,003.51	\$ 1,541.30				
HL Crankset	\$ 2,110,530.18	\$ 1,717,327.68	\$ 677,013.25	\$ 513,254.01	\$ 921,952.10	\$ 429,345.85	\$ 2,239,599.98	\$ 956,772.31	\$ 1,521,243.02	\$ 836,072.64
Touring-2000 Blue, 54	\$ 2,213,044.74	\$ 1,385,111.02	\$ 1,686,842.50	\$ 513,751.91	\$ 1,152,997.28	\$ 695,425.11	\$ 2,543,182.42	\$ 1,349,322.09	\$ 1,791,165.53	\$ 772,492.44
Mountain-500 Silver, 42	\$ 1,908,023.97	\$ 1,973,804.23	\$ 253,100.95	\$ 1,405,303.09	\$ 930,350.23	\$ 533,004.13	\$ 2,067,735.42	\$ 84,825.90	\$ 815,080.78	\$ 554,805.17
HL Mountain Frame - Black, 38	\$ 4,881,635.37	\$ 3,811,609.49	\$ 111,174.65	\$ 1,399,307.74	\$ 925,455.48	\$ 1,607,997.83	\$ 3,728,226.56	\$ 92,276.70	\$ 1,321,092.71	\$ 831,547.10
ML Mountain Frame - Black, 44	\$ 2,911,348.45	\$ 2,263,076.67		\$ 848,164.19	\$ 806,666.90	\$ 621,797.07	\$ 2,087,586.92		\$ 494,790.82	\$ 1,413,531.22
Short-Sleeve Classic Jersey, L	\$ 4,218,817.20	\$ 3,577,617.85	\$ 1,930,070.99	\$ 1,871,687.92	\$ 2,023,040.15	\$ 1,293,754.94	\$ 2,360,317.73	\$ 1,111,141.20	\$ 1,731,758.48	\$ 1,592,137.34
HL Touring Frame - Blue, 50	\$ 1,173,352.64	\$ 845,518.72	\$ 550,546.92	\$ 160,974.92	\$ 490,381.02	\$ 321,487.42	\$ 789,429.26	\$ 174,561.41	\$ 709,819.52	
ML Mountain Frame-W - Silver, 42	\$ 2,220,519.18	\$ 2,428,384.67	\$ 326,789.10	\$ 1,499,110.90	\$ 894,424.80	\$ 780,898.48	\$ 2,974,902.22	\$ 177,102.59	\$ 1,107,567.05	\$ 643,897.99
Sport-100 Helmet, Blue	\$ 13,151,819.79	\$ 10,012,730.25	\$ 1,933,804.15	\$ 5,290,038.66	\$ 2,976,226.86	\$ 4,380,844.22	\$ 6,544,184.31	\$ 888,772.77	\$ 2,717,345.66	\$ 4,724,052.82
Mountain-300 Black, 44	\$ 3,220,882.14	\$ 2,459,733.06		\$ 935,390.62	\$ 865,306.15	\$ 848,126.27	\$ 2,350,137.64		\$ 565,464.44	\$ 1,553,636.92
Road-550-W	\$ 8,680,551.09	\$ 5,540,033.21	\$ 126,611.42	\$ 3,583,661.17	\$ 1,794,745.70	\$ 2,714,002.42	\$ 2,304,896.55		\$ 1,845,020.63	\$ 3,467,453.28

Figure 9: Report in Word Doc

## What you should also know

1. **Pagination:** Once the report is opened in Word, MS-Word re-paginates the entire reports and introduces the page breaks, based on the page size. This could cause more number of page breaks being introduced, than the ones existing in the report. Those need to be re-adjusted by the user separately. Page height and width in MS-Word would be same as whatever mentioned in the height and Width properties of “.RDL” properties. Maximum width supported by MS-Word is 22 inches. So any report, which is rendered to MS-Word, whose Width is more than 22, needs to be viewed in Normal Web Layout view.
2. **Document Properties:** Following metadata would be mapped by the renderer to MS-Word document properties:
  - Report.Author - Author of the Document
  - Report Title - Title
  - Report. Description - Comment
3. **Header and Footer:** Report header and footer are rendered as header and footer regions of the document. The PrintOnFirstPage and PrintOnLastPage properties of RDL file are not supported by this renderer.

4. **Interactivity:** Some of the interactive elements that are supported in MS-Word are as follows:
  - Items configured under Show/ Hide functionality, if a specific item is shown in the report, then that will be shown in the document. Items that are not shown in the report will not be rendered into the document. The dynamic show/ hide functionality is not supported in word document as it is supported in the reports
  - If there are any document map labels existing in the report, when it is exported into word, they will be converted into Table of Contents (TOC) and the hyperlinks are created on top of the labels. The render doesn't create the TOC during the export, it needs to be created manually after rendering the report to document
  - Hyperlinks and drill-through links on text box/ image items are rendered as hyperlinks in the word document. On click of the link, the URL is navigated, using the default web browser. For drillthrough hyperlink, the originated report server will be accessed
  - While rendering a report to MS-Word, the renderer retains the sorting order, which existed in the report. Subsequently, if the sort order needs to be changed, use the sort options available in MS-Word.
  - Bookmarks in a report are rendered as MS-Word bookmarks. They are rendered as hyperlinks in the word document, while exporting report to MS-Word. The length of Bookmark label should not exceed 40 characters. Longer labels are truncated
5. **Limitations on MS-Word rendering**
  - MS-Word supports max. 63 columns in a table. So when a report with more than 63 columns is rendered, the report alignment will not be as expected
  - Word ignores report header and footer heights defined on a .rdl file
  - A document created by the renderer will have doc extension. Since Office 2007 supports doc file also, the report can be seen even by using office 2007
  - Word supports maximum page width of 22 inches. If the rendered report is crossing this limit, then the report needs to be viewed in Web layout as print layout

## Conclusion

The Microsoft technologies provide an integrated BI solution for enterprises. With the variety of presentation delivery models, advanced analytics and integration features, it suits enterprise users at all levels, from operational to analytical. Further, it gives maximum return on their investment on one single platform. Hence, SQL Server 2008 BI platform is definitely worth looking into further and evaluating for your own BI needs.

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