IBM Cognos Business Intelligence – Extreme Performance with IBM Cognos Dynamic Query

Overview
With the release of IBM Cognos Business Intelligence V10.1, the IBM Cognos Platform delivered a new 64-bit, in-memory query processing mode with dynamic query capabilities. IBM Cognos Business Intelligence Dynamic Query is an optional mode included with the Cognos Business Intelligence query service, which can be implemented to greatly enhance query performance against IBM Cognos TM1, SAP® Business Information Warehouse (SAP BW), and Oracle Essbase data sources. IBM Cognos Business Intelligence V10.1.1 includes even more performance improvements for OLAP data sources, especially when applications are implemented with Cognos TM1 V9.5.2.

Cognos Dynamic Query
Cognos Dynamic Query capabilities include optimized query generation with pattern intelligence and security-aware caching. The Cognos Platform enables report authors and advanced business users to perform the detailed ad hoc business analysis that leads to better and more timely business decisions.

Cognos Dynamic Query uses an enhanced Java™-based interface that addresses query complexity, data volumes and performance with new capabilities:

- 64-bit optimized query processing with pattern intelligence capable of combining multi-dimensional and relational concepts to improve performance against complex, heterogeneous data sources
- In-memory calculations and aggregate operations for faster computation
- Security-aware caching for query plans and data for speedy response and reduced workload on data sources

Intelligent caching
Any distributed server architecture may be affected by request latency when the environment is under increased load. Limiting excess communications and further distributing certain types of data and processing can help reduce latency.
The 64-bit security-aware smart caching of Cognos Dynamic Query uses in-memory optimization to increase query performance and data cache reuse. The system is self managed; it monitors the most frequently used data and responds accordingly.

Smart caching includes the following features:

- Scheduled and automatic management of the cache to ensure that cached contents remain relevant and timely, reducing the repetitive query load on the data source. This approach to cache management allows the use of the existing infrastructure and improves the user experience for business analytics.
- Smart load controls, to maximize the availability of memory for the most frequently accessed data, ensuring consistently faster performance.
- Cache management facilities that use existing event scheduling infrastructure to enable the automatic management of the cache, which ensures that the content remains relevant.

**Cognos Dynamic Query performance**

IBM has worked in partnership with customers, testing their production applications in order to demonstrate the performance advantages provided by Cognos Business Intelligence Dynamic Query mode. The tests performed span a wide variety of use cases, data sizes, report and charting formats, and user concurrency against each of the data sources supported for Cognos Dynamic Query mode. The tests described in this document compare the performance of applications using traditional, compatible MDX (multidimensional expression) queries to the performance of the same applications using Cognos Dynamic Query mode.

**IBM Cognos TM1 and Cognos Dynamic Query performance**

When used with IBM Cognos TM1 V9.5.2, Cognos Dynamic Query mode ensures optimal query execution by moving a significant portion of the query and metadata processing to the Cognos TM1 server. By using the power of Cognos TM1 64-bit, in-memory processing, BI query latency is greatly reduced.

The first customer test application had an in-memory footprint of 12GB in Cognos TM1. Testing included both reporting and interactive exploration gestures, focusing on one dimension within the Cognos TM1 cube, comprising 150,000 members. This customer application was developed to manage reporting and analysis for a complex manufacturing environment and included 12 different reports which were run interactively.
Figure 1, below, shows the total average report execution times across 12 reports in the complex manufacturing application test suite. Only the first report execution time is measured, as this more closely emulates the “real life” experience of a user running a report once in a given user session. This avoids use of the powerful caching facilities of the Cognos Business Intelligence Platform. The performance of subsequent individual or concurrent report runs would benefit from the use of caching and would therefore show even better performance for subsequent report runs than those shown in this test.

Figure 1: Total average response time for 12 different reports run once, simultaneously; compatible vs. Cognos Dynamic Query
In addition to normal reporting use cases, the complex manufacturing application test suite included a series of interactive data exploration gestures. Figure 2, below, shows the total average response times for individual user gestures that would be typical of a user exploring a Cognos TM1 application. Among the gestures shown in Figure 2, gestures 4 through 8 all require a significant amount of processing, and it is these process-heavy gestures that enjoy the greatest performance improvements. The improvement in the performance of gestures 4 through 8 in Figure 2 is directly attributable to the superior query and metadata work planning and advanced interactions with Cognos TM1 9.5.2, inherent to the Cognos Dynamic Query mode.

**Figure 2:** Total response time for interactive gestures; compatible vs. Cognos Dynamic Query

**Gestures/Legend:**
1 – Display aggregate level
2 – Filter using attribute
3 – Detail measure filter
4 – Sort with total
5 – Sort without total
6 – Suppress zeros in column
7 – Top count
8 – Top count without total
9 – Top count with subset of hierarchy

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![Chart showing total response time for interactive gestures]
The second customer test application had an in-memory footprint of 18GB in Cognos TM1. Testing included both reporting and interactive exploration gestures. However, this test shows the performance comparison between compatible MDX and Cognos Dynamic Query for an application under a concurrent interactive user load equivalent to the load expected for a population of 30 concurrent users (1 concurrent user = 10 active users = 100 named users).

This test case is based upon a customer’s production Sales Reporting application and uses a Cognos TM1 cube that contains 5 dimensions and a possible 9,377,523,949,248 (9.3 trillion) total intersections. Figure 3, below, shows the dimensional and cube characteristics of the Sales Reporting application used for testing Cognos Dynamic Query with Cognos TM1 9.5.2.

<table>
<thead>
<tr>
<th>Dimension-Level</th>
<th>Member Count</th>
<th>Stats By Cube</th>
<th>Sales Cube</th>
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<td>Memory Used for Views</td>
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<td>Channel Type</td>
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<tr>
<td>Year</td>
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<td></td>
</tr>
<tr>
<td>Month</td>
<td>36</td>
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</tbody>
</table>

*Figure 3: Dimensional and cube characteristics for the Sales Reporting application in Cognos TM1*
The test scenarios used for this round of concurrent user testing are typical of any product-driven Sales Reporting application, including the interactive running of pre-defined reports as well as typical user-driven interactive analysis gestures. A large cross-section of reports showing sales by Product, Geography, Time, and Plan, at varying levels of each hierarchy, were used to show the impact of varying data density and aggregation processing on Cognos Dynamic Query performance.

Figure 4 shows the total average execution times across all reports in the Sales application test suite. Only the first report execution time is measured for each concurrent request, as this more closely emulates the “real life” experience of a user running a report once in a given user session. This avoids use of the powerful caching facilities inherent to the Cognos Business Intelligence Platform. The performance of subsequent individual or concurrent report runs would benefit from the use of caching.
Cognos Dynamic Query performance for other OLAP data sources

Cognos Dynamic Query can also greatly improve performance for reporting and analysis against third-party OLAP data sources. The advanced, security-aware caching features of Cognos Dynamic Query, combined with its superior query work planning, translate into extreme performance improvements for Cognos Business Intelligence applications using Oracle Essbase and SAP BW data sources.

Cognos Dynamic Query implements a common cache that can be shared across multiple users throughout the cache life. The common cache significantly improves the performance of subsequent queries.

Example 1: User1 runs report ‘Sales Forecast by Region’ on March 1, 2011, execution time was about 40 seconds. User2 runs the same ‘Sales Forecast by Region’ report on March 15, 2011, and the report for User2 returns instantaneously. The cache lives until it’s cleared by the administrator, so it doesn’t rely on connection or session lifetime.

Example 2: User1 runs report ‘Sales Forecast by Region’ on March 1, 2011, execution time was about 40 seconds. User2 runs a different report – ‘Returns Forecast by Region’ on March 15, 2011, data returns in 20 seconds. Members of the ‘Region’ dimension were cached as a result of User1 running the report ‘Sales Forecast by Region,’ therefore the subsequent report execution of ‘Returns Forecast by Region’ will use any common cached members to improve execution.

Query performance of the overall application will gradually increase as the cache becomes more comprehensive. Cognos Dynamic Query also creates superior query work plans and therefore more efficient processing in comparison to compatible queries, thanks to the intelligent optimization of metadata and MDX requests for SAP BW and Oracle Essbase within Cognos Dynamic Query. Traditionally costly, metadata-rich queries needed to support large, detailed reports such as master detail reports also benefit from intelligent algorithms implemented within Cognos Dynamic Query, which allow the caching and reuse of data and metadata within a single report.
Figures 5 and 6, below show the performance impact of using Cognos Dynamic Query against Oracle Essbase and SAP BW with Cognos Business Intelligence for reporting and analysis applications. The test cases used to demonstrate the performance of Cognos Dynamic Query compared to compatible queries for both Oracle Essbase and SAP BW included the running of pre-defined reports generating 4 to 16 individual queries, and large master detail reports as well as interactive user gestures that are typical of OLAP-based analysis activities.

The load generated by these concurrent requests closely simulates a load that would be associated with a population of 300 active users, (1 concurrent user = 10 active users = 100 named users).

Figure 5 shows the total average response time for the execution of all Oracle Essbase test cases under concurrent user load; comparing compatible query vs. Cognos Dynamic Query.

Figure 6 shows the total average response time for the execution of all SAP BW test cases under concurrent user load; comparing compatible query vs. Dynamic Query.

Figure 5: Total average response time for 30 concurrent users; compatible vs. Cognos Dynamic Query

Figure 6: Total average response time for 30 concurrent users; compatible vs. Cognos Dynamic Query
Summary
Cognos Business Intelligence provides extreme performance advantages through the use of Cognos Dynamic Query mode along with advanced distributed caching techniques. IBM continues to demonstrate its strong commitment to customer success by partnering to ensure the highest level of performance for customer applications.

The tests described in this document are intended to stress only the Cognos Business Intelligence software components and do not account for the performance of data sources in the execution of queries. Data source servers must be managed and tuned in order to provide optimal performance. These tests do not represent a whole view of Cognos Business Intelligence software performance; and as such, the metrics presented in this document should not be used for capacity planning purposes. As with any new installation or upgrade, it is always recommended that individual applications undergo performance testing and validation in order to ensure the highest level of performance. IBM provides services specifically related to performance testing and capacity planning for Cognos Business Intelligence applications and related environmental software and hardware.

Learn more about Cognos Dynamic Query
If you are implementing Cognos Business Intelligence V10.1 and Cognos Dynamic Query, or just want to learn more about Cognos Dynamic Query, read the IBM Cognos 10 Dynamic Query Cookbook. The Cookbook can be found on the IBM Cognos Proven Practices section of developerWorks® on IBM.com – http://www.ibm.com/developerworks/data/library/cognos/infrastructure/cognos_specific/page529.html
Appendix A: Software Versions

Figure 8, below, provides the software versions used in the tests described within this document.

<table>
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<tr>
<th>Software</th>
<th>Version</th>
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<tr>
<td>IBM Cognos Business Intelligence</td>
<td>10.1.1</td>
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<tr>
<td>IBM Cognos TM1</td>
<td>9.5.2</td>
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<td>IBM DB2</td>
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<td>Oracle Essbase</td>
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<td>SAP BW</td>
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</table>

Figure 8: Software versions
About IBM Business Analytics

IBM Business Analytics software delivers actionable insights decision-makers need to achieve better business performance. IBM offers a comprehensive, unified portfolio of business intelligence, predictive and advanced analytics, financial performance and strategy management, governance, risk and compliance and analytic applications.

With IBM software, companies can spot trends, patterns and anomalies, compare “what if” scenarios, predict potential threats and opportunities, identify and manage key business risks and plan, budget and forecast resources. With these deep analytic capabilities our customers around the world can better understand, anticipate and shape business outcomes.

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