

Sybase® IQ on IBM System p™ Servers Based on New IBM POWER6™ Processor Technology

Sybase IQ benchmark demonstrates 58% performance improvement over POWER5+ processor technology

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SYNOPSIS

Sybase® IQ for IBM System p™ is a solution optimized for the demanding requirements of enterprise-class data warehousing, reporting, analytics, and aggregated data analysis. The Sybase IQ for IBM System p solution offers improved scalability and throughput performance for analytics-intensive workloads.

This report summarizes the results of a recent benchmark of Sybase IQ on four- and eight-core configurations, comparing the newer IBM POWER6™ processor technology to the IBM POWER5+™ processor technology. The benchmark used was based on a standard test of queries and data loads associated with the Sybase Risk Analytics Platform and typical of our capital markets clients. In these tests, queries involve both real-time market data (trades and quotes) and large volumes of historical financial time series data.

An earlier test conducted in November 2005 involved the same benchmark suite and methodology and demonstrated clear industry leadership over a comparably configured AMD Opteron™ system. (For the complete summary of results, see www.sybase.com/ibm). This most recent evaluation of Sybase IQ and the POWER6 processor technology extends this industry leadership by demonstrating that:

- Sybase IQ on the IBM POWER6 processor is 58% faster than on the POWER5+ processor in mixed query workload simulations of 50 concurrent users
- On the 8-core configuration, Sybase IQ is up to 131% faster than on the 4-core configuration, with relative performance gains increasing as the number of concurrent users increases. This super-scalability is due in part to Sybase IQ's unique ability to leverage cache memory and processor resources rather than I/O cycles.
- Simultaneous multithreading (SMT) is a feature enabled by default on IBM AIX® V5.3 and with it Sybase IQ demonstrates a performance advantage of up to 82% compared to when it is disabled.

BENCHMARK SUITE AND METHODOLOGY

The benchmark suite that Sybase and IBM used was the data loading scripts, queries, schema and data from a typical line-of-business application and standard use case of the Sybase Risk Analytics Platform which uses Sybase IQ as the underlying analytics server. This benchmark suite is an excellent example of high performance analytics workloads requiring fast query speeds as well as large volumes of historical data and real-time feeds to be loaded quickly into the system. For these reasons it was chosen to benchmark the latest IBM System p family of servers.

Sybase Risk Analytics Platform has been designed to pull the risk monitoring and analytics life cycle much closer to the trade order life cycle. The Sybase Risk Analytics Platform is a consolidated market data platform that delivers real-time intelligence and risk analysis. It handles market data feeds at tick data speeds and combines it with vast stores of historical data. With this kind of holistic market view, decision cycles move faster, which means improved profits with reduced risk. It is becoming clear to both buy-side and sell-side firms that the risk monitoring and control must have access to the same integrated, continually updated data through the trading cycle.

Existing technology infrastructures are struggling to keep pace with a rapidly evolving industry. In recent years, securities trading has been undergoing radical changes due to both the availability of new technologies and changes in the regulatory environment. The rate at which trading and portfolio decisions are made has risen significantly, with profound implications on the business process infrastructure. Model-driven, quantitative trading applications are replacing conventional trading desks. The search for profits is leading to investments that accelerate trading decisions, pre-trade analytics, and trade order generation. Risk management is now a real-time decision process that extends from the front office to the back office, so all players need access to the same data view at the same time.

Sybase Risk Analytics Platform addresses these requirements, enabling companies in capital markets to capture, consolidate, and leverage the many types of data involved in complex asset allocation and trading decisions.

The benchmark suite consisted of two tests:

Market Data Load Test simulates inbound data capture of securities trading data from market data vendor-delivered files against the Sybase Risk Analytics Platform data model. The data load rates into the Sybase Risk Analytics Platform repository built in the Sybase IQ analytics server was measured in terms of inserts per second, per hour, and per processor.

Query Test represents the typical tick queries used in pre-trade analysis and security pricing. These queries are used to build workload streams for a number of user connections. Response times for each query and for the user workloads were measured. Also represented were historical queries used in quantitative model development and scenario-based back testing to assess the efficacy of trading strategies and risk controls.

SERVER CONFIGURATIONS

Two IBM servers were tested with three different processor configurations including variations between number of processing units and processor speed.

Server and O/S	Specification	Processing Units	Processor Speed
p5-570 (AIX V5.3 TLo6)	8-core, 32GB	POWER5+	2.2 GHz
p570 (AIX V5.3 TLo6)	8-core, 32 GB	POWER6	4.7 GHz
p570 (AIX V5.3 TLo6)	4-core, 16GB	POWER6	4.7 GHz

IBM Total Storage® DS4800 Configuration

The IBM Total Storage® DS4800 configuration includes four RAID-5 arrays with fourteen 73GB 15K RPM Ultra SCSI 3 HDD each, spread equally across two storage controllers. These storage controllers were connected to the host system with two fibre-channel adapters, rated at a 2-Gbps data rate. Each array is configured with three 280GB LUNs, which are exported as raw devices to the host system.

BENCHMARK TEST PLAN

The benchmark test plan was divided into three major comparisons. The first compared the performance of Sybase IQ on the POWER6 vs POWER5+ processor-based servers. Within this test, two sets of results were gathered. The first set of results captured data loading speeds into Sybase IQ, and the second set of results captured query processing times with different numbers of concurrent users with Sybase IQ.

The second benchmark test compared results of having the SMT feature “on” or “off” on the POWER6 processor. The data loading and query processing speeds were compared in each case.

Third, a scalability benchmark test was performed on the POWER6 processor, to show Sybase IQ performance on POWER6 configurations of 8 cores vs 4 cores.

BENCHMARK RESULTS

1. POWER6 vs POWER5+ performance

The test results demonstrate the performance advantages of Sybase IQ on the POWER6 processor-based server over the performance on the POWER5+ processor-based server.

Market Data Load Test – The nominal test results are tabulated below. The tests are based on number of streams of data feed per target table. The results are in gigabytes inserted per hour per core and measure the data flow rate into the data repository in Sybase IQ.

	GB/Hour/Core (cumulative queries)	
	16 Stream Binary Data Ingest	3 Stream ASCII Data Ingest
POWER5+ 8-core with SMT	7.407	6.1517
POWER6 8-core with SMT	11.2538	8.9624
Performance improvement	52%	46%

This test indicates that POWER6 processor technology provides data-driven enterprises with significant advantage. More data can be loaded and accessible in Sybase IQ for analysis or reporting in a faster period of time.

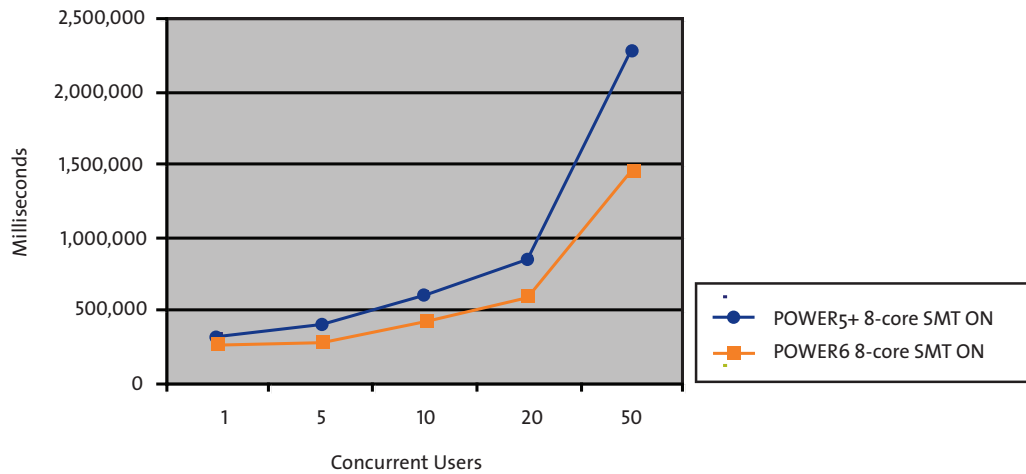
Query Tests – The test suite consisted of six tick queries and nine historical queries. These tests are server-side queries that test the database engine performance; the computational processes in the queries are lightweight and no attempt has been made to build complex mathematical operations into the queries as this would introduce code level variations into the results.

The test involved a large database (~1.6 billion rows, approximately 220GB) reflective of front office/middle office systems that are being designed to support intra-day risk monitoring of trading desks. The query tests were conducting with the default SMT feature turned “on” and “off.”

Comparing cumulative query processing times of all queries demonstrates that Sybase IQ on the POWER6 processes queries up to 58% faster than on the POWER5+ (in milliseconds, from 1 to 50 concurrent users).

	1 user (msecs)	5 users (msecs)	10 users (msecs)	20 users (msecs)	50 users (msecs)
POWER5+ 8-core with SMT	313,906	397,532	605,724	855,858	2,308,842
POWER6 8-core with SMT	252,417	282,086	422,828	592,270	1,459,035
Performance improvement	24.36%	40.93%	43.26%	44.50%	58.24%

Performance Comparison – POWER 5+ vs POWER 6
Cumulative response times for mixed queries (tick and historical) for varying users
Lower is better



2. Simultaneous Multithreading (SMT)

SMT is a hardware multithreading technology which enables the execution of multiple instructions from independent code paths, or hardware threads, in a single clock cycle. Simultaneous Multithreading (SMT), first available on the POWER5 processor, moves beyond simple thread switching to the maintenance of two thread streams that are issued as continuously as possible to ensure the maximum use of processor resources. AIX V5.3 is the first release providing support for Simultaneous Multithreading (SMT) and POWER5 is the first IBM POWER-based processor to implement this technology.

Although SMT is implemented in physical hardware, it is enabled at the operating system layer, requiring operating system software awareness of this feature. This also means that SMT can be enabled or disabled for each LPAR on a physical server independently. SMT is a feature enabled by default on AIX V5.3.

This section presents the impact of SMT in a system configuration where a single Logical Partition (LPAR) utilizes dedicated processors.

Configuration	LPAR type	Number of Cores	Logical Processors
8- core SMT Enabled	Dedicated	8	16
8-core SMT Disabled	Dedicated	8	8

	1 user (msecs)	5 users (msecs)	10 users (msecs)	20 users (msecs)	50 users (msecs)
POWER6 8-core SMT ON	252,417	282,086	422,828	592,270	1,459,035
POWER6 8-core SMT OFF	257,172	327,727	516,454	862,281	2,655,975
SMT performance advantage	1.88%	16.18%	22.14%	45.59%	82.04%

The table above demonstrates that utilizing SMT when running Sybase IQ analytics server on an IBM POWER6 processor-based system has a significant positive performance impact on the transaction response times. It also shows that the benefit of SMT increases as workloads place higher demand on processor resources.

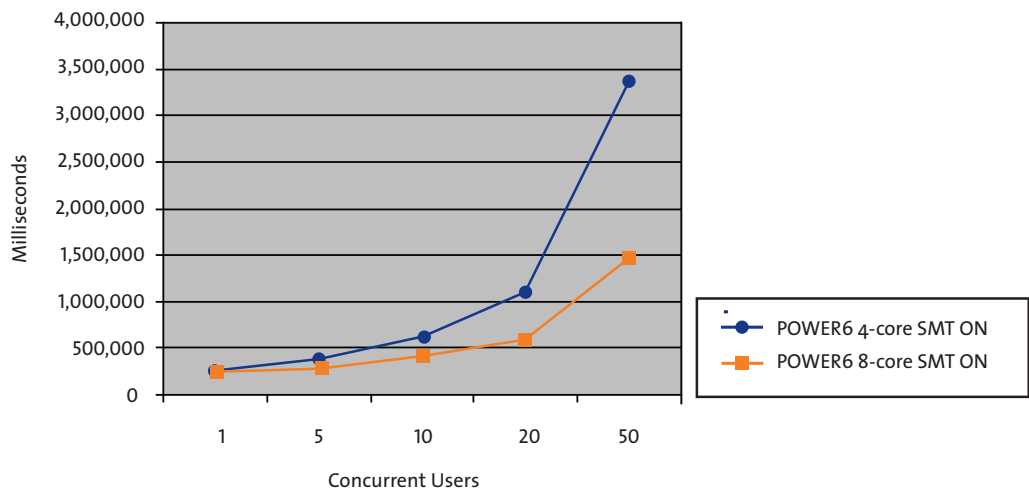
3. Scalability

Tests were conducted to compare both query processing speeds and data load speeds on the 4-core and the 8-core POWER6 configuration.

When comparing query processing speeds, Sybase IQ on the POWER6 processor demonstrated excellent scalability, particularly as the number of concurrent users increased. The table below illustrates 131% scalability in the 1- to 50-user test.

	1 user (msecs)	5 users (msecs)	10 users (msecs)	20 users (msecs)	50 users (msecs)
POWER6 4-core with SMT	265,007	377,766	621,456	1,096,928	3,376,891
POWER6 8-core with SMT	252,417	282,086	422,828	592,270	1,459,035
8-core performance improvement	4.99%	33.92%	46.98%	85.21%	131.45%

*Scalability Test – 4-core vs 8-core POWER6
Cumulative response times for mixed queries (tick and historical) for varying users
Lower is better*



This “super-scalability” is explained by the way Sybase IQ leverages processor resources vs I/O cycles. Normally, one would expect 100% or less scalability, commensurate with the increase in processing power. In this instance, Sybase IQ is probably sharing cache data as the number of concurrent users increases. It is likely that two or more of the user streams were concurrently executing queries that required similar data from the database. Thus, once the data is loaded into memory by a user’s query, the second or third query that requires the same data would be able to use the cached data, rather than spending I/O cycles to load from disk.

When comparing data loading speeds, the 8-core system was able to load 68% more gigabytes of data per hour into Sybase IQ.

	GB/Hour/Core	
	16 Stream Binary Data Ingest	3 Stream ASCII Data Ingest
POWER6 4-core with SMT	6.6924	5.4148
POWER6 8-core with SMT	11.2538	8.9624
8-core performance improvement	68%	66%