Not-So-Silent Strengths of DB2 Universal Database:
An examination of the strengths of the IBM DB2 family

Jeff Jones

IBM Data Management Solutions
Silicon Valley Laboratory
IBM Corporation
Drummer@us.ibm.com

APRIL 2001

Introduction

DB2 Universal Database is rapidly gaining momentum in the database industry. Its presence and power on UNIX, Windows and OS/2 are becoming more and more evident. Its continuing and growing strength on traditional platforms like eServer iSeries (formerly AS/400) and zSeries (formerly S/390), combined with its momentum on UNIX, Windows and OS/2, add up to form a very potent package. DB2's not-so-silent strengths in areas including platform independence and portability, Internet architecture and support, scalability, availability, benchmarks, marketshare, consulting costs and total cost of ownership are discussed below. The strengths of DB2 as a foundation for e-business infrastructure have never been more evident.

This paper examines the strengths of the DB2 family in light of recent criticisms from the Oracle point of view.

Platform Independence/Portability

The DB2 UDB code base on UNIX, Windows and OS/2 is roughly 90% the same. We reserve, on average, 10% of the code to optimize down into the operating system and sometimes the hardware. This is vital to achieve the performance, reliability, security and scalability we demand of DB2 on UNIX (including Linux), Windows and OS/2. A pure porting strategy can't achieve this level of capability. Examples of our downward integration include Intel's VI Architecture support for standards-based clustering in Intel server environments, integration with AIX HACMP, Sun Solstice and Microsoft Cluster Server for scalability, and use of Windows and Kerberos security and multi-threading schemes.

The code base for DB2 UDB for AS/400 and for DB2 UDB for OS/390 and z/OS are two distinct code bases, and distinct from DB2 UDB on UNIX, Windows and OS/2 platforms. Because of the distinct hardware and OS architectures on these platforms, and because they are IBM platforms with which we can more deeply and tightly integrate, we have different internal architectures for DB2. This provides much better performance and scalability than a porting strategy such as Oracle's, particularly on S/390 and eServer zSeries. Oracle has not attempted to build a database for AS/400 and eServer iSeries.

Internal differences should not be mistaken for external differences. There are a limited number of external variations seen by database administrators and application developers between the three distinct DB2 code bases. We have had for a few years now an effort to drive differences out of the SQL interface across platforms, not only to implement standards wherever possible, but to become virtually the same across platforms. This work continues. As the programming paradigm continues to shift to server side logic (stored procedures) in languages like Java and the standard SQL Procedure Language, even minor differences in behavior of database systems become less and less relevant.

One of the benefits of IBM's approach is simultaneous innovation that can be folded in across the family. The powerful encoded vector index used in DB2 UDB for AS/400 is being examined for implementation on other platforms. The object-oriented extenders to DB2 for managing rich forms of information were born on UNIX, Windows and OS/2 and were implemented quickly on other platforms.

To further simplify the lives of DB2 DBAs, our administration toolset, notably the DB2 Control Center, extends its reach across multiple code bases to allow a single DBA from a single workstation to manage multiple instances of DB2 on not only UNIX, Windows and OS/2 but also on OS/390 and z/OS. Our new standards-based SQL Procedures Language for writing stored procedures and our cross-platform Stored Procedure Builder are further evidence of cross-platform compatibility.

Another dimension to this argument is the notion of functional capabilities of our editions of DB2 on UNIX, Windows and OS/2. Precisely the same functional capability is offered in the four packages on these platforms: Personal Edition, Workgroup Edition, Enterprise Edition, Enterprise-Extended Edition. This is not the case for Oracle. Oracle's Standard Edition is a subset of the capability of their Enterprise Edition. We do not have this weakness. Our editions differ only by scaling capability (single servers to SMP servers to clusters).

It is our view that a 100% porting plan, which is Oracle's historic strategy, cannot optimize performance for any particular platform. To not take advantage of underlying system strengths would be doing a huge disservice to customers.

Internet Architecture

DB2 UDB was the first relational database to ship built-in support for Java (for writing user-defined functions and stored procedures) and for JDBC. This occurred back in December 1996 with the shipment of DB2 Common Server Version 2.1.2, one of the immediate predecessors to DB2 Universal Database which first shipped in September 1997. We followed this with built-in support for SQLJ for static SQL via Java programs, again becoming the first database vendor to do so (with DB2 Universal Database Version 5.2 shipping in September 1998). DB2's is an Internet standards-based implementation. As customer- and user-written articles in DB2 Magazine attest, building Internet or intranet or extranet applications on DB2 UDB is a natural process not requiring services contracts from us or others.

More recently, IBM has collaborated with Sun, Hyperion and Oracle themselves, to deliver a proposed standard for OLAP processing from Java applications. The work is called JOLAP. We remain in the forefront of activities to unite the Web and other variations of the network with relational database technology. Other standards efforts to which we contribute more than most of our competitors combined include SQL itself, the Common Warehouse Metamodel for exchange of meta data in a warehouse environment, and Predictive Model Markup Language for data mining. Interoperation among relational databases is also governed by a standard largely based on DB2's Distributed Relational Database Architecture (DRDA).

Our integration with WebSphere and its enterprise Java support extends this capability even further. Enterprise JavaBeans and Java servlets are indeed supported in this integrated environment. We have supported distributed Java-based transactions via JDBC Version 2 and the Java Transaction APIs since the shipment of DB2 Universal Database Version 7.1 in June 2000. XML is another key Internet technology, and we have provided a no-charge XML Extender to DB2, providing XML-aware text search, an XML datatype, and complete integrated XML management capabilities since December 1999, now included as a no-charge part of Version 7.1. The DB2 Text Extender has been enhanced to perform XML-aware searches as well.

Optimizing performance of Java-based applications is what customers want. Having an integrated, specialized JVM, as Oracle does, is an approach to providing high performance which causes Oracle to have to maintain its own dialect of Java. (He who owns a JVM owns a dialect of Java.) IBM has chosen to integrate DB2 with the platform JVM (i.e. the JVM available from the underlying operating environment) and to optimize the performance of DB2 UDB in this integrated environment. One such optimization is DB2's new static ODBC query support. Getting static SQL high performance out of a dynamic ODBC query environment is just one of a number of techniques that DB2 is providing for customers' requirements for high performance in an Internet universe.

Rich and diverse data (multimedia, XML, spatial, flat files) are the norm for Web applications. Our Extenders have attacked this customer requirement since their birth with the DB2 Text Extender in July 1995, well before Oracle or even Informix and the "Universal Server war" of 1997. Since then we have indeed developed a full range of multimedia and spatial extenders and also developed the DB2 Data Links Manager for managing file data in place. It is an optionally priced feature of DB2 UDB available on AIX, Windows NT/2000 and Solaris starting out with DB2 UDB V5.2 which shipped in September 1998. As of Version 7.1, DB2 Data Links Manager is priced at just $8,000 per processor, where DB2 UDB is priced at $17,500 per processor (SMP) or $22,500 per processor (clusters). So, DB2 Data Links Manager is less than half the license cost of DB2 Universal Database even with the lower SMP price tag. For customers wishing to extend DB2's relational management to file data, this price represents a high value proposition. And DataLinks provides a much more feasible manage-in-place solution for information of this kind, where Oracle Internet File System requires a costly move of all data into Oracle databases, following Oracle's "rip and replace" strategy.

Hidden Consulting Costs

DB2 UDB does not have hidden consulting cost, pure and simple. Advancements in installation and adminstration of DB2 UDB make it accessible to customers of all sizes. Certainly consulting services can be employed to build and enhance implementations for customers, but DB2 UDB does not make them mandatory. Oracle's combined database/application server/applications approach does not make them immune to services providers. Customers are just as likely to desire services in an Oracle environment, particularly application and SQL tuning services, as they are to desire services in a DB2 environment. SQL tuning is a known area of heavy manual intervention for Oracle database installations. Advantages of DB2 UDB in this area are documented in the D. H. Brown Associates white paper on five-year total cost of ownership, in which they compare DB2 and Oracle.

Growth/Scalability/Availability

Oracle and DB2 have vastly different approaches to high-end scalability. Oracle favors a single shared memory or shared cache architecture on all platforms implemented solely in the database software. DB2 favors a shared nothing approach on UNIX, OS/2 and Windows, and a shared memory (with integrated hardware assistance) on S/390. Oracle, as told to IBM by database analysts, has difficulty pointing to any reference customers of Oracle Parallel Server, their clustered implementation. At this writing, Oracle also has no clustered TPC-C standard

benchmark entries in the top ten measured by performance looking at all results, clustered or non-clustered. A shared memory or shared cache architecture creates the need to solve complex high-volume transaction traffic management problems, hence the need for the as yet unshipped Real Application Clusters. DB2's shared nothing architecture on UNIX, Windows and OS/2 does not face these challenges. Witness DB2's July 2000 Windows 2000 clustered TPC-C results, currently #3 in the TPC-C top ten list by performance. (See http://www.tpc.org for details.) These, as well as a variety of ERP and CRM application benchmark results, demonstrate DB2's unique ability to scale to the highest heights. Also, DB2 UDB on UNIX platforms are used in more than 100 customer implementations where one terabyte or more of data are managed.

On S/390, Telstra, an Australian telecommunications company, has just won the grand prize for largest OLTP database on any platform awarded by Winter Corporation in the Database Scalability Program 2000 competition. Telstra's OLTP system has 10.36 terabytes and 81 billion rows of data in DB2 UDB for OS/390. The world's largest database installations continue to be on DB2. DB2's integrated hardware/database/operating system approach to shared resource management goes well beyond Oracle's shared memory or cache architecture. Both DB2's best OLTP (Telstra) and best DSS showings (Telecom Italia with DB2 UDB for OS/390, 3.71 terabytes, 23.598 billion rows) in the Winter Corp. competition exceeded Oracle's best showings. (See http://www.wintercorp.com for more information.)

For high availability, IBM is recognized particularly on S/390 and zSeries for the ultimate in reliability. On UNIX and Windows platforms, DB2 integrates with IBM AIX HACMP, with Sun Solstice and with Microsoft Cluster Server to provide failover support. This support is not new. We're partnering with SteelEye (see http://www.steeleye.com/news/pr022601.htm) to provide this same high availability soon on DB2 UDB for Linux clusters, on which DB2 UDB already scales in near-linear fashion.

A key component in this category is a set of tools to provide rapid recovery should failure occur and to enable DBA work to be done on the database while it is processing application and end user requests. DB2's utilities have evolved over the years to do just that. In fact, DB2 does provide online reorg (despite Oracle's claim), and this capability is spreading throughout the DB2 family.

Administration of a clustered shared nothing DB2 environment is made simpler by tools provided in the Control Center, a standard (no additional charge) component of DB2 Universal Database on UNIX, Windows and OS/2. In fact, the Control Center enables DBAs to administer DB2s on SMP servers, on clusters and even on S/390, from a single point. A data rebalancing tool is included to tackle a requirement unique to our shared nothing architecture. Benchmarks and customer testimony confirm near-linear scalability for DB2 UDB. Customer references exist (as opposed to the lack of Oracle clustered references).

Concurrency and locking challenges are common in Oracle's shared memory approach. Our shared nothing architecture avoids this problem by dividing application work and data among nodes in the cluster, with results assembled and presented to the application when all pieces are complete. Locking and concurrency are less a factor in this DB2 environment, therefore no need for enhancements like Oracle's upcoming Real Application Clusters. Parallelism among servers in the cluster and within each server can better be applied to solve business problems using DB2's architecture.

Benchmarks/Real World Scalability

Our results speak for themselves. Visit http://ibm.com/software/data/db2/benchmarks for a long list of standard (e.g. TPC) and ERP/CRM application benchmarks. No other database vendor has posted a body of results across OLTP, DSS and Web workloads, in both laboratory and real world environments, showing the kind of scalability demonstrated by DB2 (on platforms as diverse as AS/400, S/390, AIX, Solaris, NUMA-Q PTX, Linux, and Windows 2000). Note that Oracle bases some of its claims on the notion of named users. Named users need not be doing active work with the database to be counted. Counting named users (users that have the potential to use the system) is of no benefit to customers trying to gauge operational scalability.

As Oracle continues to alienate application partners like Siebel, SAP and PeopleSoft, partners are standardizing on DB2, enabling us to work in concert with them to tune and strengthen DB2's already strong application performance. The future promises to widen the performance gap.

Oracle has posted no TPC benchmark results (TPC-W) for Web workloads of any kind on any platform despite heavy marketing claims about Oracle's Web integration and support. Oracle prohibits in its license agreement any kind of comparative analysis or benchmarking versus its competitors. DB2 has no such restriction.

Technology such as our cost-based optimizer, our automatic query rewrite capability and automatic summary tables are patented techniques behind our performance leadership in both OLTP and warehousing environments. These techniques apply in heterogeneous database environments too, where DB2's optimization can be applied across multi-vendor environments using DB2 DataJoiner and the newly integrated Oracle distributed query capability in DB2 UDB Version 7.1 which shipped in June 2000. Our commitment to both homogeneous and heterogeneous multi-vendor database environments is unique to IBM and DB2. It represents our strategy of integration, federation and optimization, not centralization and homogenization. IBM is applying this technology today in the Life Sciences industry through our product DiscoveryLink, which uses technology from DB2 Universal Database and DB2 DataJoiner.

Leading Market Share... Logical Choice...

Dataquest indicated in their 1999 database marketshare analysis that it was a two-horse race between IBM and Oracle, differing only by about one percentage point. In the UNIX and Windows markets, where Oracle enjoys the larger marketshare, IBM has experienced 13 straight quarters (as of 4Q00) of double-digit and sometimes triple-digit revenue growth. This length of exceptional growth has led some analysts to predict IBM will take second place in the near future in UNIX and Windows environments. This growth and intensified competition are recognized by Oracle, hence its escalating anti-IBM PR and advertising activities. DB2 remains the only database in the large AS/400 community; it remains the dominant database on S/390 with roughly 96% marketshare per Dataquest at YE99; it remains, for 13 straight quarters as of YE00, the fastest growing database on UNIX and Windows platforms.

Siebel has noted in financial disclosures the notable contribution to their bottom line that DB2 has made recently. Other application partners have strengthened their initial DB2 partnerships in recent months. If DB2 performance or function were inferior, no amount of anti-Oracle sentiment would have convinced them to shift to DB2 as they have. A combination of our technology, our breadth of optimized, deeply integrated platform support (including Linux), and our dramatically more cost effective pricing have been cited by partners as attractors. Of new application seats sold by Siebel, the share running on DB2 has grown from about 2% in 4Q99 to about 30% in 3Q00. Quoting Siebel: "We made this strategic commitment to IBM DB2 for several reasons. We have done exhaustive benchmarking of our application suite on DB2 versus Oracle and other leading database management systems. Without question, DB2 is the highest performance, most scalable database platform for an enterprise deployment of the Siebel Enterprise Applications. DB2 enables our customers to fully exploit the power of the Web-based Siebel 99 product line. With DB2 our customers can harness the full power of the Internet to establish and maintain customer relationships. Completely integrated. Entirely Web-based. Fully supported by both IBM and Siebel. Low cost. This is a big win for Siebel Systems customers worldwide."-- Thomas M. Siebel, chairman and CEO, Siebel Systems, Inc.

Note that Oracle does not cite value, cost of ownership or price in their strengths rationale. Analysts have noted the license charge advantage of DB2, and the also significant multi-year total cost of ownership (TCO) advantages of DB2. (More on TCO below.) DB2 also offers strictly per processor pricing in SMP and cluster environments on UNIX and Windows, making it enormously more simple for customers to determine DB2's cost, and enabling them to upgrade processors to higher speeds without affecting database license charges.

Quest Software, Oracle's most prolific DBA tools partner, has begun offering a DB2 toolkit, recognizing the potential in our rapid growth and robust capability.

Total Cost of Ownership

By now, the total cost of ownership (TCO) studies published by D. H. Brown Associates and by Yevich, Lawson & Associates are well known. The reports document the strong TCO advantages of DB2 UDB in a variety of scenarios. They are available on the Web and can be distributed without restriction in their entirety (http://ibm.com/software/data/pubs/tech-consult.html.) Mark Shainman of META Group has been quoted repeatedly, saying license charges for DB2 UDB are in many cases from three to five times lower than those for Oracle. Alexa Bona of Gartner has been quoted in TheStreet.com saying, "By 2001, Oracle's Power Unit model will be as much as 230% more expensive than the processor-based model." (http://www.thestreet.com/_yahoo/tech/software/1121901.html)

If you add a hardware dimension to this TCO analysis and compare DB2 UDB on RS/6000 (eServer pSeries) vs Oracle on Sun E10000, the arithmetic is dramatic: DB2 UDB on an IBM p680 is at least nine times less expensive than Oracle on a Sun E10000. This conclusion is based on several findings: (a) META Group, January 2001: Oracle on a Sun E10000 is almost twice as expensive as Oracle on an IBM p680, and (b) IBM p680 has more than 50% better transaction throughput than Sun E10000, and earlier from META Group, (c) in many instances DB2 UDB is from three to five times less expensive. Delivering high-value solutions to our customers' data management requirements is our business. This is true for our data management middleware (DB2 Universal Database) as well as for our combined server/middleware solutions.

Conclusion

With technology leadership, significant investment, rapidly growing partner acceptance and preference, solutions of high value, and deep commitment to satisfying customers' diverse data management requirements, the less and less silent strengths of DB2 keep getting stronger.

For additional information on this topic see:
DB2 offers superior capability:
- August 2000, eWeek Lab's Analyst's Choice Award to DB2 UDB
  http://www.zdnet.com/eweek/stories/general/0,11011,2610819,00.html
- December 2000, InformationWeek Research database comparison ("Database Grudge Match"), DB2 best in 7 of 10 categories
  http://www.informationweek.com/815/database.htm
- December 2000, Java Report's Writer's Choice award for database tools to DB2 UDB
  http://www.javareport.com/html/from_pages/oldarticles.asp?ArticleID=1925

IBM partners well with DB2:
- September 2000, VARBusiness Annual Report Award, first place in database category
  http://www.varbusiness.com/Sections/News/BreakingNews.asp?ArticleID=20279
- October 2000, Siebel 2000 Partner Award of Excellence

Customers are doing cutting edge, large scale, award winning things with DB2:
- August 2000, CMP Media's RealWare Award to Bank of Montreal for their DB2 data warehouse and data mining implementation
  http://www.realwareawards.com/2000win_pr.shtml
- October 2000, 2000 Microbanker Awards to Dallas Teachers Credit Union for their DB2 data warehouse implementation
  http://www.microbanker.com/artarchive/101500btsSecondPlaceBESTINMICROBANKING.html
- January 2001, Winter Corp.'s 2000 Database Scalability Program grand prize in OLTP category to Telstra for their DB2 UDB for OS/390 system
  http://www.wintercorp.com/GPWinners.htm

NOTE: All of the above are listed at: http://www.ibm.com/software/data/awards

Web References for Additional Information

- IBM Data Management Solutions: http://ibm.com/software/data
- IBM DB2 Universal Database: http://ibm.com/software/data/db2
- Benchmarks: http://ibm.com/software/data/db2/benchmarks
- White papers: http://ibm.com/software/data/pubs
- News: http://ibm.com/software/data/news
- Case studies: http://ibm.com/software/data/solutions
- DB2 Magazine: http://www.db2mag.com