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Cost/Benefit Case for IBM DB2 11.1 Compared to Oracle Database 12*c* for OLTP Deployments

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Market Situation

For organizations looking to make critical choices regarding IT infrastructure needs, the options have never been so plentiful. On-premises, cloud, and hybrid alternatives for delivering IT resources have enabled organizations to customize solutions to their needs and existing assets. A key driver of enterprise-wide planning, operating, and reporting, the corporate database platform, remains a central consideration no matter how diverse the IT landscape has become. The database platform selected will affect organization-wide businesses processes, and choosing a secure, reliable platform that is readily compatible with the new innovations will serve to minimize cost of ownership.

Online transaction processing (OLTP) solutions continue to evolve to meet the growing needs of enterprises. There is a steady momentum of new deployments and legacy replacements of enterprise resource planning (ERP), e-commerce, and a wide range of other systems. A plethora of applications is also being deployed to enable web and mobile transactions, while maintaining high levels of performance and availability. Despite the fast pace of technology innovations, organizations worldwide report, at best, incremental growth in IT budgets, while cost controls continue to be rigorously imposed. Companies aiming to improve the efficiency and performance of essential systems should adopt a database platform that is cost effective, flexible, and scalable to more effectively meet the increasing workloads of tomorrow.

This paper presents a cost/benefit case for two leading enterprise database contenders—IBM DB2 11.1 for Linux, UNIX, and Windows (DB2 11.1 LUW) and Oracle Database 12*c*—with regard to delivering effective security capabilities, high-performance OLTP capacity and throughput, and efficient systems configuration and management automation.

Comparisons are of database installations in the telecommunications, healthcare, and consumer banking industries. For OLTP workloads in these environments, three-year costs average 32 percent less for use of DB2 11.1 compared to Oracle 12*c*. (Figure 1)

Disparities in full-time equivalent (FTE) database administrator (DBA) staffing levels and corresponding personnel costs for Oracle 12*c* are much larger. For the same installations, three-year personnel costs for use of DB2 Advanced Enterprise Server Edition (AESE) average 49 percent less than those for Oracle Database 12*c*.

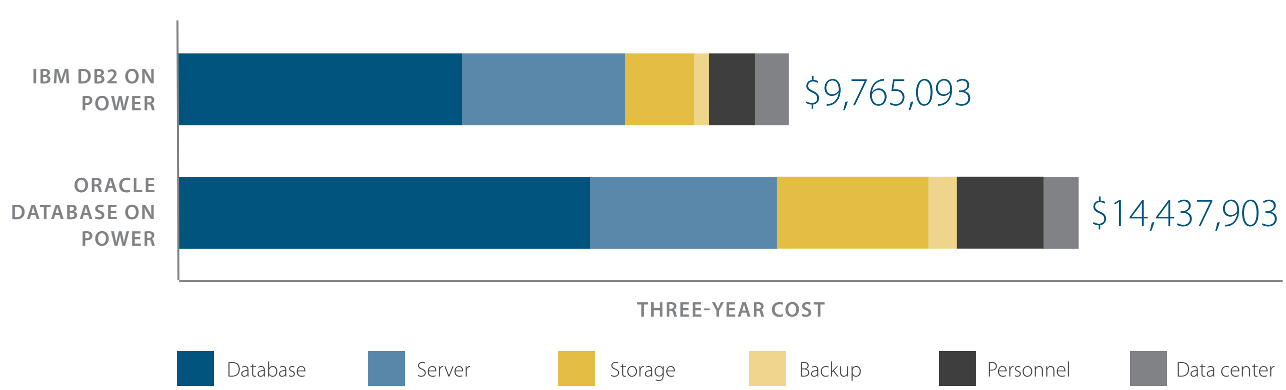
Assumptions employed in constructing composite company profiles were based on information supplied by organizations worldwide that employ either DB2 and/or Oracle databases, or have migrated from one to the other. Detailed functional comparisons of DB2 11.1 LUW and Oracle Database 12*c* that highlight relationships between technologies and costs are also discussed.

There are compelling reasons to pay close attention to database investments. Databases determine, in no small measure, how effectively an organization can leverage information for business advantage—whether to mine and nurture new and/or existing customer sales opportunities, verify customer satisfaction, or to discover operational inefficiencies. To a much greater extent than is generally realized, the database platform influences an organization's year-over-year IT cost trajectories. A highly available database remains as important as ever in ensuring business continuity, and the ubiquity of databases makes their effective configuration and efficient administration crucial to an organization's productivity.

OLTP Technology Differentiators

IBM DB2 11.1 LUW and Oracle Database 12*c* compete as two of the most established enterprise database platforms. The March 2017 availability of the latest version of Oracle Database 12c, Release 12.2 for cloud and on-premises, updates and adds to the feature set launched in July 2013. The June 2016 release of IBM DB2 11.1 LUW includes enhancements and new capabilities developed and/or acquired during the three years prior to its launch.

FIGURE 1: Average Three-year Costs for IBM DB2 11.1 Advanced Enterprise Server Edition and Oracle Database 12*c* Enterprise Edition for Transaction Processing Installations



In comparing DB2 11.1 LUW and Oracle Database 12*c*, it is important to distinguish between what a particular feature has been designed to accomplish, and how efficiently it functions in practice. The characteristics of transactional workloads are significantly different from those of analytics. The former involve frequent reads and writes to a few rows of data at a time, rather than sequential scans of large volumes. Such databases are also typically smaller than for analytical systems, and I/Os involve smaller blocks of data.

Business-critical applications require high levels of availability and disaster recovery capability. Performance is largely determined by the efficiency of core data structures. Inefficiencies of these code structures may increase processor, memory, and disk overhead; reduce throughput; increase risks of bottlenecks and outages; and produce other undesired effects.

In all of these areas, there are significant differences between IBM DB2 11.1 LUW and Oracle Database 12*c*. DB2's automatic database tuning and management features are beneficial when databases undergo frequent changes in size, schemas, underlying data structures, and workloads. Using Oracle Database methods and features in such environments generally requires manual solutions, configured using elaborate administrative processes, at considerable additional expense.

IBM has invested significantly in SQL compatibility to simplify the adoption of and transition to DB2. Organizations that have migrated Oracle Database applications to DB2 11.1 LUW have typically found that 98 to 99 percent of code remains unchanged, and few changes to development skills are required. Native support for Oracle Procedural Language/Structured Query Language (PL/SQL) and open source PostgreSQL, along with a wide range of code, tools, and functions commonly employed by administrators and developers, is built into the core database engine rather than implemented as a software overlay. Thus, organizations will experience the same levels of performance as native DB2 11.1 LUW users.

DEPLOYMENT FOUNDATIONS

For on-premises deployments, DB2 offers exceptional scalability and flexibility through integration with the pureScale clustering solution. DB2 pureScale was designed to provide extreme scalability and continuous availability of transaction processing across enterprise environments. IBM Spectrum Scale software-defined storage is integrated with pureScale clusters to allow enterprises to customize and optimize their storage infrastructure. Oracle Real Application Clusters (RAC) is a database clustering technology designed to support scale-out server deployments, as well as HA clustering, although it has been deployed mainly for the latter.

Multiple node, parallel database deployments, commonly known as *clusters*, are distributed database configurations that involve a number of independent compute nodes working together as one. Database clustering is generally classified as either *shared-disk* or *shared-nothing* based on its fundamental deployment design. The shared-disk architecture supports instances running on multiple, networked compute nodes, each with equal access to all data storage in the cluster. The shared-nothing design consists of database instances running on multiple nodes, each with exclusive access to distinct memory and storage resources in the cluster.

In avoiding downtime for business-critical systems, IBM DB2 pureScale offers greater efficiency, flexibility, and throughput, as well as more rapid failover and recovery for high-volume workloads than the Oracle RAC multi-partition database environment.

Because shared-disk designs utilize node-based caching and locking mechanisms, the complexity of lock management may become a significant bottleneck limiting scalability and throughput. Caching may also be less efficient due to the large amount of shared data each node has access to. Overhead may prove problematic if workloads are not assigned efficiently among processing nodes.

Designed to optimize the processing of transaction workloads, DB2 pureScale architecture consists of members that independently process requests with their own resources, but access shared data. DB2 pureScale enables centralized locking and caching capabilities through a cluster caching facility (CF). Although originally based on the Parallel Sysplex implementation of mainframe DB2 data sharing, the design of DB2 pureScale is a hybrid of shared-disk and shared-nothing architectures, combining the best features of each.

DB2 pureScale design enhancements included in DB2 11.1 LUW achieve substantial performance and scaling improvements, while simplifying installation and deployment.

A DB2 11.1 LUW pureScale system can scale to 128 database servers, while providing continuous availability and automatic load balancing. Each connection to a pureScale cluster can access a shared, single database image; although, pureScale allows for the use of multiple databases within a single instance. Automatic workload balancing enables the rerouting of processing to members with more available resources. The detection and automation of pureScale failure recovery is simple and efficient due to robust storage replication commands, proven Spectrum Scale file system capabilities, cluster CF strengths, and PowerHA technology.

The DB2 *Configuration Advisor* automatically sets database configuration parameters to optimize performance at database creation, reducing the amount of database tuning that is typically required later. The *health monitor* tool provides database health information through snapshots and does not degrade performance. *Utility throttling* further regulates utilities and tools to ensure performance is not negatively impacted.

Data Server Manager (DSM) is a tool that consolidates monitoring, tuning, configuration, and administration of DB2 databases, allowing administrators to manage DB2 instances with one centralized tool, using a browser-based graphical user interface (GUI). And the text-based, low overhead *dsmtop* tool allows users to monitor key performance indicators. Users can set high refresh rates for dsmtop to achieve near real-time monitoring. Both of these tools are used to simplify database administration and management while increasing operational efficiency.

OPTIMIZATION AND AUTOMATION

For most of IBM DB2's history, emphasis on simplification and automation have been a major part of its design. Core DB2 features allow DBAs to perform tasks with fewer, simpler actions, in less time than their Oracle counterparts. High levels of automation reinforce these characteristics.

Autonomic technologies are employed with numerous features, such as the wide variety of tools used for database tuning and performance optimization. Queries against a DB2 pureScale database are automatically offloaded to members with high resource availability. Scaling out with DB2 pureScale is simple, and members can be added without requiring repartitioning, application changes, or performance tuning, because the database topology is transparent to applications. In contrast, Oracle RAC's share-everything architecture is not transparent to applications and requires DBAs to extensively test applications for scalability.

Routine file and storage management within a DB2 pureScale system is handled by Spectrum Scale, the high-performance distributed file system installed with DB2 pureScale. *Automatic table and index maintenance and reorganization* features simplify storage management and maintenance by reducing data fragmentation.

Oracle Automated Storage Management (ASM) and Oracle ASM Cluster File System (ACFS) provide comparable functions for Oracle Database 12*c*. However, Oracle ACFS is less integrated than Spectrum Scale, only supporting database files in the most recent releases under certain conditions. Oracle's dynamic rebalancing strategy does not help optimize workload processing performance because it simply focuses on balancing disk space without considering workload characteristics and I/O statistics.

DB2's *self-tuning memory*, in particular, is an industry leading self-tuning technology. Available for each member in a DB2 pureScale environment, it automatically and iteratively adjusts configuration parameters to allocate resources optimally for memory performance. DB2 automated storage management, database maintenance, installation, and other processes are more extensively automated than Oracle equivalents. This automation contributes not only to DBA efficiency, but also to performance (system parameters may be adjusted more rapidly and efficiently than with manual techniques) and availability (risks of performance bottlenecks and human error are reduced).

Compared to Oracle RAC, DB2 pureScale generates lower levels of cluster overhead. Requirements for DBA intervention are also lower for such tasks as initial configuration, expansion, addition of new applications, workload balancing, performance optimization, and testing.

COMPRESSION

Storage compression technology in DB2 11.1 LUW is more effective than in Oracle Database 12*c*. This results in greater savings in storage hardware and software tools, in backup systems and media, and in data center energy and occupancy costs.

For OLTP applications, *Adaptive Compression* improves upon compression rates achieved using classic table-level compression. This capability, introduced in DB2 10.1, incorporates a set of compression algorithms that supplement table compression using page-level compression techniques.

The new in-core Nest Accelerator NX842 hardware on POWER7+ and POWER8 servers boosts performance when compressing DB2 backup and archive logs on AIX . This innovation offloads such operations from CPU resources, and achieves greater hardware compression ratios than is possible with software compression routines.

Due to these advanced compression and autonomic features, users who migrated to DB2 have reported an average of 43 percent reduction in backup time.

The Oracle equivalent, Advanced Compression, remains essentially as implemented in Oracle Database 11g R1 in 2007. It uses a heat map to determine the activity level of data blocks and compresses the tiered data accordingly. Oracle Advanced Compression tends to be most effective when databases are highly structured, and undergo few changes over time. Advanced Compression may not be as effective for highly transactional workloads involving frequent changes to data. According to Oracle's own documentation, "users should consider turning off compression on very high traffic or very small tables..." Advanced Compression tends to be recommended for systems with high CPU availability, due to its potential to generate high levels of overhead.

Users who have migrated to DB2 from Oracle reported an average of 47 percent reduction in storage requirements. On average, DB2 users have also experienced an additional 39 percent increase in compression rate.

ENCRYPTION AND SECURITY

DB2 encryption capabilities are integrated into core processing and apply to data in storage as well as data in transit. For data in transit between client and database server, Secure Sockets Layer (SSL)—sometimes referred to as Transport Layer Security (TLS)—technology is supported. For data at rest, *DB2 Native Encryption* provides secure encryption and key management, which are transparent to applications and schemas, and protect both the database and any backup images created. This symmetric encryption scheme also automatically detects and exploits hardware acceleration for cryptographic operations, such as the Intel AES-NI. DB2 on AIX can further leverage the AIX encrypted file system to protect all files in the system.

DB2 10.5 first provided support for native encryption by using a per-instance, local file keystore mechanism. Since the 10.5 release, DB2 has utilized FIPS (Federal Information Processing Standard) 140-2 certified cryptographic libraries and cryptographic algorithms that meet the requirements of NIST (National Institute of Standards and Technology) SP 800-131a.

Support for a centralized keystore in DB2 11.1 LUW allows for use of remote, centralized management of all encryption keys. DB2 11.1 LUW's ability to use the IBM Security Key Lifecycle Manager (ISKLM) keystore, for example, ensures master key management industry standard compliance with the Key Management Interoperability Protocol (KMIP) 1.1. In addition, DB2 11.1.1.1 offers direct support for Hardware Security Modules (HSMs) such as the Gemalto (formerly Safenet) Luna SA HSM and Thales nShield Connect+.

DBAs can also use row and column access control (RCAC) to manage user access to tables at the row- or column-level, enabling an additional level of security and customization. Label-based access control (LBAC) allows administrators to further tailor access to meet an organization's needs by enabling read and/or write access based on specific criteria, such as a user's ability to see information that has been classified as being *Top Secret*.

User identity authentication within DB2 can be managed via the operating system, through a Lightweight Directory Access Protocol (LDAP) server, or using the Kerberos protocol. DB2 also manages which operations a user is authorized to conduct on specific data or resources. This is controlled either directly through database-level authorities and privileges that are associated with a specific user ID or through the creation and use of database roles, which can be used to combine several database-level authorities and object privileges together.

Oracle Advanced Security offers similar capabilities, but only as an extra-cost option for Oracle Database Enterprise Edition. Advanced Security uses Transparent Data Encryption (TDE), encrypting data at rest in the database layer. Oracle Key Vault allows for master key management, but requires a separate license for each server installation. SSL/TLS are also supported by Oracle Database.

Vulnerabilities and potential exposure to risk have increased as the universe of hybrid and managed cloud services continues to expand. There is no question about how critical security is when choosing the best database platform. Both Oracle Database and IBM DB2 support similarly impressive lists of encryption and authentication compliance standards; however, in 2016, Oracle Database had 11 vulnerability alerts, whereas IBM DB2 had only two, according to NIST.

DB2 11.1 LUW improvements in security strategies are responsible for these kinds of results.

HIGH AVAILABILITY

Among DB2 pureScale enhancements are built-in failure detection, recovery automation, and a data-sharing architecture. DB2 pureScale can also be integrated with High Availability Disaster Recovery (HADR), a widely used disaster recovery solution comparable to Oracle's Data Guard and Active Data Guard. Both vendors' solutions allow users to combine central HA clusters with remote site failover and recovery.

Valuable availability and manageability improvements are evident in DB2 11.1 pureScale. Because DB2 pureScale can now distribute members across geographic locations using geographically dispersed DB2 pureScale cluster (GDPC) technology, the level of disaster recovery protection has broadened. DB2 pureScale reduces planned downtime for mission critical workloads by enabling online rolling maintenance, such as patches, hardware and firmware updates, and operating system fixes.

For mission critical workloads requiring the highest availability, DB2 pureScale's active/active replication minimizes downtime. If one member fails, all remaining members remain active, and most data is unaffected.

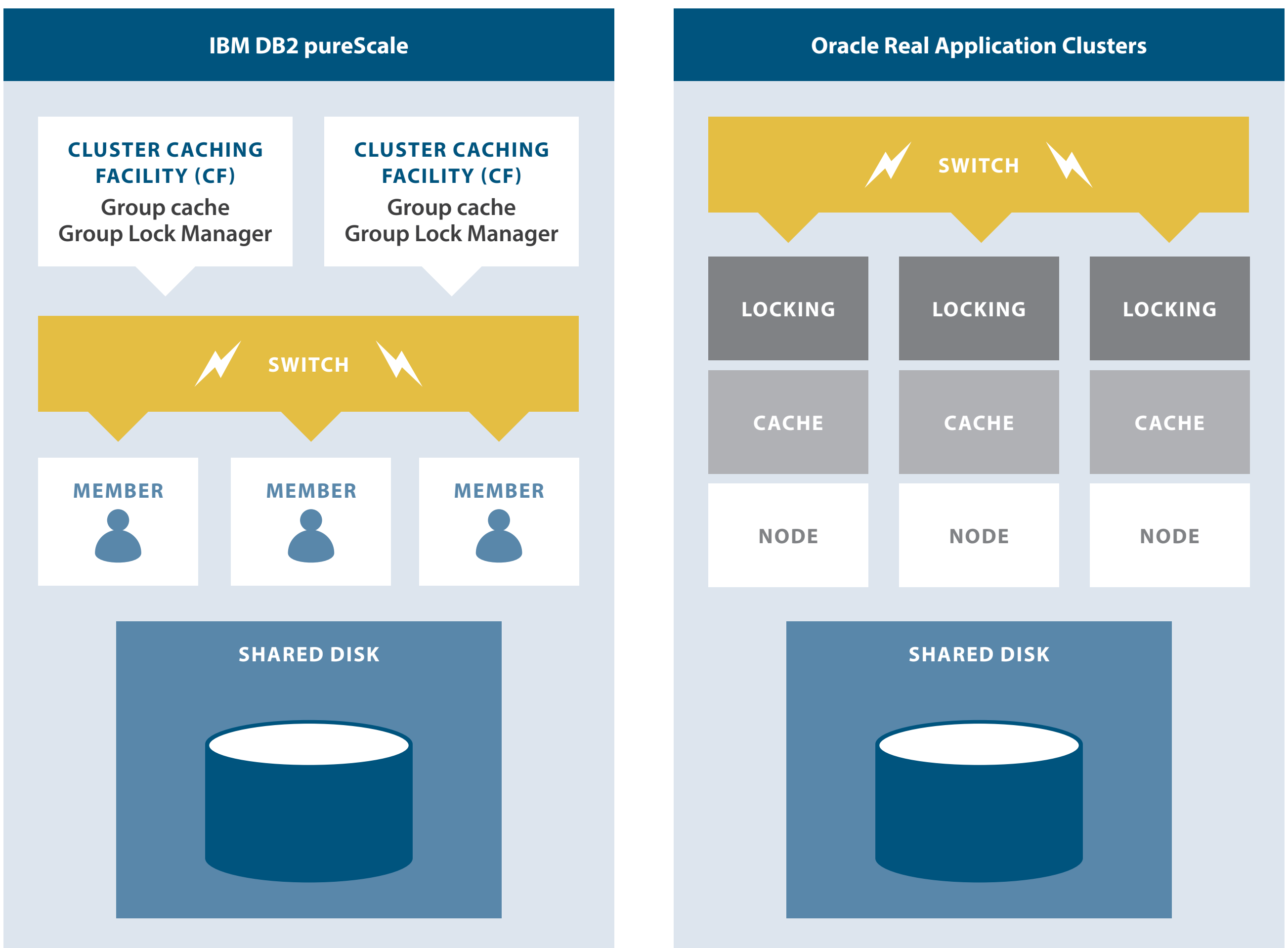
In the event of a DB2 member failure, recovery only requires in-flight data to be locked by DB2, contrasted to the locking of all data during Oracle recovery. DB2 cluster services will automatically restart any failed resources or members in the DB2 pureScale instance. Members can be restarted either on their original host or a different host, without affecting the rest of the instance. During recovery, rollback of in-flight transactions is prioritized to free locks and maintain consistency. This is not the case with Oracle Database, which has to be re-instantiated in passive standby node(s).

DB2 cluster services also provide automatic, heartbeat failure detection and recovery. Failed members are automatically isolated from the cluster system. During recovery of a failed member, the database instance remains available and accessible to all other cluster members. Applications and clients whose connections to the failed member are momentarily disrupted, are automatically rerouted to another member in the cluster.

CFs also contribute to rapid failover and recovery by providing a shared buffer pool that coordinates caching across cluster members. CFs contain data from local buffer pools and can act as a shared communication area, which server members may use as cluster-wide shared memory. In addition to buffer pool management, CFs provide global locking capabilities to ensure data concurrency and to prevent data corruption. These centralized attributes result in faster failover and recovery, because navigating through local caches and locking mechanisms is not required. (Figure 2)

In addition, the Tivoli System Automation for Multiplatforms feature provides self-healing capabilities through the detection of improper operations of systems, transactions, and processes, and initiates corrective actions without disrupting application users. This feature automatically and transparently

FIGURE 2: IBM DB2 pureScale and Oracle Real Application Clusters Architecture



moves applications within the cluster to facilitate continuous availability, eliminating the need for manual monitoring.

In comparison, Oracle RAC clusters with failed nodes must go through a lock redistribution process that may take minutes to complete. Database processes are frozen until the system determines what needs to be recovered. For large-scale, business-critical systems, a large number of transactions and records may be impacted. DB2 pureScale mitigates this complex, protracted process, because its centralized locking and cache management capability is not affected by individual member failures. CFs are also redundant to protect against CF failure.

PACKAGING AND PRICING

IBM offers DB2 11.1 in a variety of product editions to provide flexibility for customers. At the high end, DB2 Advanced Workgroup Server Edition (AWSE) and AESE include high value features such as encryption, pureScale, and BLU Acceleration technology. *DB2 BLU Acceleration* is a collection of integrated features such as in-memory columnar processing, Actionable Compression, and Data Skipping to enable high performance analytics.

For Oracle Database, comparable features must be purchased as add-on products. For example, Oracle Data Guard requires licensing of all database standby cores, contrasted to DB2 HADR's requirement of licensing one standby core.

Table 1 summarizes DB2 11.1 AESE components and a comparable Oracle stack. Oracle U.S. list prices shown are per processor unless otherwise indicated.

Customers who have migrated to DB2 typically report up to 40 percent reductions in software and middleware licensing costs. For large deployments, these savings can add up to millions of dollars.

TABLE 1: DB2 11.1 LUW AESE Components and Oracle Database 12*c* Enterprise Edition Equivalents

FUNCTION	DB2 11.1 LUW AESE	Oracle Database 12*c* Enterprise Edition	
	No-cost Features	*Extra Cost Options*	*List Price*
Disaster recovery	HADR	Data Guard	Included*
Data compression	Table Compression	Advanced Compression	$11,500
Advanced security	Label Based Security	Label Security	$11,500
Data partitioning	Table Partitioning	Partitioning	$11,500
Clustering	pureScale	Oracle RAC	$23,000
Active/active replication	Q-replication	Active Data Guard	$11,500
Column organized	BLU Acceleration	Oracle In-Memory	$23,000
TOTAL PRICE			$92,000

*Details explained in the Packaging and Pricing section of this document.

Cost Details

The cost comparisons presented in this paper are for three installations of DB2 11.1 LUW AESE and equivalent Oracle Database 12*c* Enterprise Edition software stacks in telecommunications, healthcare, and consumer banking companies. These installations are summarized in Table 2.

Configurations reflect input from user surveys and from others with similar business profiles, application portfolios, and database characteristics. Performance, compression, FTE staffing and other variables employed were based on information from users that had deployed DB2 and/or Oracle databases for similar applications, or had migrated from Oracle to recent versions of DB2.

Resulting configurations and FTE staffing levels were as shown in Tables 3 and 4.

TABLE 2: Transaction Processing Installations Summary

TELECOMMUNICATIONS COMPANY	HEALTHCARE ORGANIZATION	CONSUMER BANKING
Business Profile		
Wireless & Internet access services provider $2+ billion sales 20 million subscribers 14,000 employees	Healthcare provider with multiple hospitals & clinics $3 billion sales 2,500 beds 15,000+ staff	Diversified retail bank $30 billion+ assets 200+ branches $1+ billion revenue 5,000+ employees
Applications		
Billing, CRM, operational systems, data store	EMR, HIS, PACS, business applications, departmental	Core banking systems

TABLE 3: Configurations and FTE Staffing Summary for DB2 11.1 on Power Systems

TELECOMMUNICATIONS COMPANY	HEALTHCARE ORGANIZATION	CONSUMER BANKING
Databases + Tools		
DB2 11.1 AESE, including pureScale	DB2 11.1 AESE, including pureScale	DB2 11.1 AESE, including pureScale
Database Servers		
4 x 880 192 x 4.0 GHz *AIX, PowerHA*	4 x 880 160 x 4.19 GHz *AIX, PowerHA*	4 x 880 160 x 4.19 GHz *AIX, PowerHA*
Storage		
FlashSystem 900 x 342 TB *SAN Volume Controller, Spectrum Scale*	FlashSystem 900 x 228 TB *SAN Volume Controller, Spectrum Scale*	FlashSystem 900 x 456 TB *SAN Volume Controller, Spectrum Scale*
Backup		
Storwize V7000	Storwize V7000	Storwize V7000
Personnel		
1.75 FTEs	1.15 FTEs	1.65 FTEs

Cost details for installations are presented in Tables 5 and 6.

Costs were calculated as follows:

Database software costs were based on use of DB2 11.1 LUW AESE and Oracle Database 12*c* Enterprise Edition with the extra cost options shown in Table 1, providing equivalent functionality to DB2. The AIX operating system was used for both databases.

DB2 pureScale and Oracle RAC were employed as clustering solutions. Calculations include three-year software licensing and support fees. DB2 licenses were based on Processor Value Units and Oracle Database licenses were based on per processor prices.

Storage and backup costs were based on use of FlashSystem 900 and Storwize V7000, respectively. FlashSystem 900 arrays were employed with IBM MicroLatency Modules in RAID 5 configurations. Storwize V7000 enclosures with 600 GB small form factor disks were used for backup. Storage and backup were sized to estimated installation requirements.

Database server calculations were based on use of IBM Power Systems E880 servers. The AIX 7.2 operating system and PowerVM virtualization were employed for all installations. Calculations for the telecommunications, healthcare, and consumer banking organizations include IBM PowerHA SystemMirror failover clustering software.

Personnel costs were calculated based on estimated annual salaries of $112,097 for Oracle Database with RAC DBAs, and $106,476 for DB2 DBAs with pureScale certification. These estimates were based on industry standard salaries for each database that were available online. Salaries were increased by 43.7 percent to allow for bonuses, benefits and other per capita costs, and multiplied for three years.

TABLE 4: Configurations and FTE Staffing Summary for Oracle Database 12*c* on Power Systems

TELECOMMUNICATIONS COMPANY	HEALTHCARE ORGANIZATION	CONSUMER BANKING
Databases + Tools		
Oracle Database 12*c* Enterprise Edition Stack, including RAC	Oracle Database 12*c* Enterprise Edition Stack, including RAC	Oracle Database 12*c* Enterprise Edition Stack, including RAC
Database Servers		
4 x 880 192 x 4.0 GHz AIX, PowerHA	4 x 880 128 x 4.35 GHz AIX, PowerHA	4 x 880 128 x 4.35 GHz AIX, PowerHA
Storage		
FlashSystem 900 x 969 TB *SAN Volume Controller, Spectrum Scale*	FlashSystem 900 x 342 TB *SAN Volume Controller, Spectrum Scale*	FlashSystem 900 x 912 TB *SAN Volume Controller, Spectrum Scale*
Backup		
Storwize V7000	Storwize V7000	Storwize V7000
Personnel		
3.25 FTEs	2.35 FTEs	2.8 FTEs

TABLE 5: Three-year Cost Breakdown—Use of IBM DB2 11.2 LUW AESE

	TELECOMMUNICATIONS COMPANY	HEALTHCARE ORGANIZATION	CONSUMER BANKING
IBM DB2 11.1 pureScale on IBM Power Systems			
DB2 11.1	4,685,990	3,123,994	3,123,994
Support	1,171,498	780,998	780,998
Database Total ($)	5,857,488	3,904,992	3,904,992
Server	936,234	624,156	624,156
Software + Support	2,441,120	1,627,413	1,627,413
Server Total ($)	3,377,354	2,251,569	2,251,569
FlashSystem 900	892,290	594,860	1,189,720
Software + Support	223,073	148,715	297,430
Storage Total ($)	1,115,363	743,575	1,487,150
Storwize V7000	89,306	53,424	71,365
Media	244,860	81,620	163,240
Backup Total ($)	334,166	135,044	234,605
THREE-YEAR SYSTEM TOTAL ($)	10,684,370	7,035,180	7,878,316
Personnel cost	827,621	543,865	780,328
Facilities	662,400	441,600	441,600
THREE-YEAR TOTAL COST ($)	12,174,391	8,020,645	9,100,244

TABLE 6: Three-year Cost Breakdown—Use of Oracle Database 12*c* Enterprise Edition

	TELECOMMUNICATIONS COMPANY	HEALTHCARE ORGANIZATION	CONSUMER BANKING
Oracle Real Application Clusters 12*c* on IBM Power Systems			
Oracle Database 12*c*	4,473,600	3,728,000	3,728,000
Support	2,952,576	2,460,480	2,460,480
Database Total ($)	7,426,176	6,188,480	6,188,480
Server	936,234	780,195	780,195
Software + Support	2,441,120	2,034,266	2,034,266
Server Total ($)	3,377,354	2,814,461	2,814,461
FlashSystem 900	2,528,155	892,290	2,379,440
Software + Support	632,039	223,073	594,860
Storage Total ($)	3,160,194	1,115,363	2,974,300
Storwize V7000	107,247	71,365	143,129
Media	326,480	163,240	489,720
Backup Total ($)	433,727	234,605	632,849
THREE-YEAR SYSTEM TOTAL ($)	14,397,450	10,352,909	12,610,090
Personnel cost	1,619,917	1,171,324	1,395,621
Facilities	662,400	552,000	552,000
THREE-YEAR TOTAL COST ($)	16,679,767	12,076,233	14,557,710

DBA employment across organizations is affected by variations in applications supported, types of administrative tasks performed, and job description differences. For this paper, FTEs required for each company profile are based on user surveys. Organizations that have conducted migrations from Oracle to DB2 report two to three times reductions in FTE staffing levels.

Data center cost calculations include data center occupancy and energy consumption, as well as allowance for acquisition, maintenance, and operational costs for data center infrastructure equipment, such as uninterruptible power supplies (UPS), power distribution systems (PDS), and cooling systems. Costs for power usage were calculated based on national averages per kilowatt-hour (kWh). Costs were calculated using a conservative assumption for annual average cost per square foot for existing facilities (i.e., costs do not include new facilities construction).

All costs are in shown in U.S. dollars.

Conclusions

Enterprise business-critical applications rely more than ever on an OLTP database platform that can meet record high levels of uptime, deliver real-time responsiveness in HA clustering, and demonstrate unfaltering disaster recovery capabilities. DB2 11.1 LUW and DB2 pureScale have been enhanced with a wide variety of features and tools to enable automated tuning and performance optimization. Oracle RAC architecture, which is not transparent to applications, requires extensive DBA application configuration, testing, and tuning to efficiently optimize the manual assignment of cluster resources.

Three-year costs of transaction processing environments in telecommunications, healthcare, and consumer banking companies, average 32 percent less for DB2 11.1 compared to Oracle 12*c*. Much of the cost variance can be attributed to resource requirements driven by differing data compression techniques, workload management mechanisms, degrees of administrative complexity, and vendor packaging and pricing.

Core database structures used to execute OLTP are generally more lightweight and less complicated in DB2 11.1, generating lower levels of system overhead than those of Oracle Database 12*c*. Storage compression technology in DB2 11.1 LUW is more effective than in Oracle. Smaller and simpler configurations mean greater savings in storage hardware and software tools, in backup systems and media, in personnel costs, and in data center energy and occupancy costs.

SQL compatibility enhancements in DB2 11.1 LUW help enable applications written for other relational databases to execute in a DB2 environment in a majority of cases without requiring code modifications. This also reduces the time and complexity of migrating to DB2. Organizations that have migrated to DB2 have typically experienced reductions in storage requirements, as well as in licensing costs.

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