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MANAGEMENT BRIEF

Value Proposition for IBM DB2 9.7

Cost/Benefit Case for SAP Enterprise Migrations

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TABLE OF CONTENTS

List of Figures

EXECUTIVE SUMMARY

Changes and Opportunities

The SAP world is changing. Economic conditions remain weak in most industries and geographies, but organizations have begun to invest again in capabilities that will enhance competitiveness and enable long-term growth.

At the same time, far-reaching shifts are occurring within the SAP solution portfolio. New tools allow information to be exploited as a powerful, pervasive tool for business gain. Migration to SAP Business Suite 7 offers the potential to improve organizational flexibility and responsiveness in volatile, globalized markets. Technological shifts offer a broad range of new opportunities.

But opportunities cannot be realized only at the application level. Changes in underlying system infrastructures must also occur. The potential emerges to make such changes a positive force – not only by ensuring that infrastructures deliver scalability and resilience to handle growth far into the future, but also by creating new levels of cost-effectiveness.

This report is about this potential. Specifically, it looks at the cost savings and functional benefits that may be achieved by migrating SAP database infrastructures from Oracle to IBM DB2.

Now is a good time to be dealing with this issue. Within the next few years, many existing Oracle users will evaluate the option of migrating to Oracle Database 11g Release 2 (11.2), which has now been certified by SAP.

The alternative is to migrate to IBM DB2. The latest version, DB2 9.7 optimized for SAP, retains its edge in cost-effectiveness. In examples presented in this report, users deploying new SAP systems are able to reduce three-year database infrastructure costs by an average of 37 percent by using DB2 9.7 rather than Oracle Database 11g. For users migrating to DB2 9.7, three-year costs average 27 percent less.

DB2 offers other benefits. The new DB2 pureScale architecture enables users to realize mainframe-class scalability and availability in a non-disruptive manner. Close integration with and optimization for SAP Business Suite 7 boosts performance, and minimizes deployment and operational risks.

The option emerges to build next-generation SAP database infrastructures around DB2. This option may not be attractive to organizations whose commitments to Oracle preclude change. But for others, it offers one of the largest return on investment (ROI) opportunities in the SAP world today.

Comparative Costs

It will come as no surprise that DB2 9.7 costs less than Oracle Database 11g. DB2 licenses are priced by SAP at 8 percent of SAP Application Value (SAV), compared to 15 percent for Oracle, and support costs are correspondingly lower. However, this proves to be only part of the picture.

If allowance is made for DB2 9.7 performance, data compression and automation capabilities, the potential for savings is significantly larger. Reductions occur not only in database software costs, but also in costs for storage systems, database and system administration personnel and other IT resources.

This potential may be illustrated by comparisons of three-year costs for use of Oracle Database 11g and DB2 9.7 for Business Suite 7 installations in three companies: a $7 billion manufacturer of industrial machinery, tools and parts; a $6 billion aerospace manufacturing and systems integration company and a $5 billion manufacturer of electronic systems, components and subassemblies.

For all three installations, user input was employed to develop scenarios for use of Oracle Database 11g and DB2 9.7 to support Business Suite 7. Scenarios included database, disk and tape storage configurations and full time equivalent (FTE) staffing for database and storage administration. Two sets of costs were then calculated:

1. ***Baseline costs***. In a simple comparison whose results are summarized in figure 1, it is assumed that organizations deploy new SAP solutions.

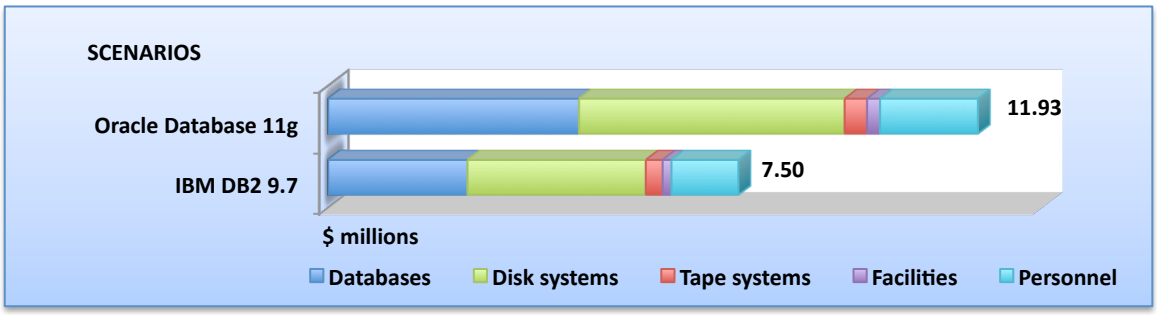

Figure 1: ***Baseline Costs Comparison – Averages for All Installations***

Costs include database licenses and support; hardware acquisition and maintenance, and systems software licenses and support for disk systems; hardware, maintenance and media costs for tape systems; facilities costs (including data center occupancy and energy) for disk and tape systems; and FTE personnel costs including salaries and benefits.

2. ***Migration costs.*** In this comparison, it is assumed that organizations migrate from Oracle Database 11g to DB2 9.7 at the beginning of the three-year cost period. Results are summarized in figure in figure 2.

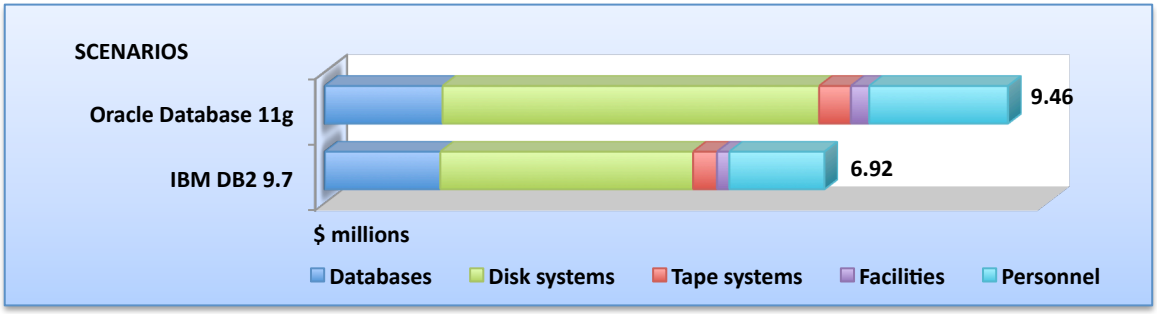

Figure 2: ***Migration Costs Comparison – Averages for All Installations***

Database costs for use of Oracle Database 11g are support fees only, as it is assumed that organizations already have Oracle installed. Database costs for DB2 9.7 are adjusted to include transition costs for data conversion and staff retraining, and to allow for IBM migration pricing incentives. Other costs are the same as for baseline comparisons.

In practice, most organizations migrating to DB2 9.7 would replace Oracle Database 10g, whose capabilities are more limited than those of Database 11g. Savings would typically be larger.

Additional information on installations, applications, configurations, platforms and staffing levels, along with methodology and assumptions employed for these calculations, may be found in the Detailed Data section of this report. Granular cost breakdowns are also presented in this section.

Capability Differences

Since 2005, IBM has offered versions of its DB2 database developed in close cooperation with SAP. Formally titled DB2 optimized for SAP, these are not the same as mainstream DB2 versions. Features have been closely optimized and finely tuned for use in SAP environments.

By 2009, when SAP certified the latest DB2 optimized for SAP Version 9.7, DB2 had established a clear lead in such areas as performance, compression and automation over Oracle 10g. Oracle Database 11g, certified by SAP in April 2010, provided enhancements that narrowed, but did not close gaps in functionality between the two databases.

DB2 pureScale clustering, which at the time of writing was in beta test among SAP users, was certified by SAP in 2010. DB2 pureScale combines de facto 100 percent availability with the ability to execute and manage workloads transparently across multiple physical platforms – the architectural limit is 128 nodes – with minimal system overhead. DB2 pureScale is implemented in DB2 9.8, an extension of 9.7.

According to IBM, in non-SAP environments, DB2 pureScale overhead ranges from less than 5 percent with 32 nodes to around 16 percent with 128 nodes. Early experiences with SAP systems have shown near-linear scalability with up to four nodes.

DB2 pureScale competes with Oracle Real Application Clusters (RAC). There are significant differences between these that affect costs. One is that, while DB2 pureScale increases the SAP OEM DB2 license price from 8 to 10 percent of SAV, use of RAC increases the Oracle OEM price from 15 to 18 percent. A second is that, unlike DB2 pureScale, RAC requires significant modifications to existing applications.

In addition, DB2 is the first major database to support the ***SAP NetWeaver BW Near-Line Storage (NLS) solution***. This capability, which is included in SAP IBM DB2 OEM licenses at no extra cost, allows organizations to offload significant portions of SAP NetWeaver BI (formerly SAP Business Warehouse) databases to lower-cost near-line SAS or SATA disk drives.

These and other capability differences are discussed in the following section of this report.

Risk Factors

Once organizations have deployed enterprise-wide SAP systems, they become fundamentally dependent upon them. SAP solutions have a pervasive, long-term impact on business efficiency and competitiveness. If structural flaws or inefficiencies became embedded within SAP systems, or within infrastructures supporting them, the impact may be both serious and long lasting.

Additionally, the SAP world is increasingly dynamic. Business requirements, application portfolios and technology bases all change more rapidly than in the past. This has particularly been the case since the global economic downturn began in 2008. Delays in deploying new SAP solutions, or in implementing upgrades, may not only drive up costs, but also deprive business users of critically needed capabilities.

Many organizations see the exceptionally close relationship between SAP and IBM in DB2 development and support as materially reducing such risks.

In late 1999, SAP moved from Oracle to DB2 as its strategic database for internal development. All new generations of SAP systems, including Business Suite 7, have been developed on this platform. DB2 is SAP's "preferred and recommended" database for Business Suite 7 solutions.

There have been significant benefits to users in a number of areas. The most obvious of these is that DB2 optimized for SAP is designed to handle the applications and workloads that are characteristic of evolving SAP environments.

Benefits, however, have also been realized in other areas. These include:

- ***Time to market***. Since the introduction of DB2 8.2 in 2005, new versions of DB2 are typically available for DB2 optimized for SAP in less than two months. This has not been the case for Oracle, where delays have been measured in years. Figure 3 shows differences in general availability for recent new versions of both databases for non-SAP and SAP users.

Database	General Availability	General Availability for SAP	Delay (Months)
Oracle 9i	June 2001	February 2003	18
Oracle 10g	January 2004	April 2006	27
Oracle 11g	July 2007	April 2010	30
DB2 9.1	July 2006	August 2006	2
DB2 9.5	October 2008	December 2008	2
DB2 9.7	June 2009	August 2009	2
DB2 9.8	January 2010	March 2010	2

Figure 3: ***Oracle and IBM DB2 General Availability Differences***

- ***Maintenance alignment***. As organizations typically plan for SAP solution upgrades based on end of service (EOS) dates for SAP maintenance, challenges are materially reduced if cycles are aligned with those of SAP.

  IBM policy is to ensure that this is the case. End of service for DB2 optimized for SAP versions coincides with the SAP "7+2" cycle – i.e., seven years of mainstream and two years of Extended Maintenance. DB2 end of service coincides with the end of Extended Maintenance. There is no comparable Oracle commitment.

A further area of DB2 risk mitigation should be highlighted. Migration of SAP systems from Oracle and other databases may be performed with minimal exposure. In the last few years, hundreds of organizations have decided to move from Oracle Database to DB2 to manage their SAP application data.

Migration processes may leverage expert professional services offered by SAP and IBM, using SAP's Migration Risk Mitigation methodology. This allows for in-depth planning and analysis, as well as multiple phases of migration and testing over a period of weeks to months.

Distinctive DB2 capabilities – including deep compression, which accelerates data conversion and load processes, and "silent installation," meaning the ability to auto-configure DB2 production and non-production DB2 instances – also facilitate migration.

Although database migrations still pose significant challenges, the evolution of automation technologies has reduced costs and shortened timeframes to a greater degree than is generally recognized. In this as in other areas, DB2 automation features are the most advanced of any major database.

Conclusions

Databases are the heart of any SAP infrastructure. Database capabilities materially affect the overall performance, quality of service and cost-effectiveness of SAP systems and the underlying IT resources that support them.

As organizations move to the next generation of SAP solutions, the opportunity emerges to put in place new databases that will sustain growth in SAP data, workloads and user populations throughout the Business Suite 7 lifecycle. The costs of doing so will be outweighed, by wide margins, and in only a few years, by the savings that will be generated.

CAPABILITY DIFFERENCES

Infrastructure Issues

The relative importance of functionality, cost and risk has been debated in the SAP community for decades. The general conclusion has been that, because business performance has become so tightly linked to SAP capabilities, cost cutting per se is not a desirable objective.

Equally, however, there has been a growing recognition that, in many organizations, there are significant opportunities to improve the cost effectiveness with which SAP systems are deployed, operated and supported. Consolidation of SAP systems and infrastructures – including servers, storage and data centers – has been widespread since the 1990s. Single global instances have become increasingly common.

SAP has itself initiated addressed Total Cost of Ownership (TCO) through use of best practices in such areas as cost/benefit measurement, business alignment, portfolio streamlining and operational procedures. SAP TCO methodologies do not, however, address costs of underlying system infrastructures. There are two compelling reasons to pay attention to these.

One is that the demands on system infrastructures continue to increase. Growth in installed storage capacity among large SAP users, for example, is routinely in the range of 30 to 50 percent per year. Some applications, such as business intelligence and records retention, typically experience higher levels. Greater use of analytics tools and technologies will accelerate future growth.

These effects will be compounded by Unicode transitions. SAP users who have implemented Unicode have typically experienced increases of over 60 percent in database size. As data volumes expand, organizations are also faced with mounting costs and difficulties for cloning, cross-system replication, backup and archiving, disaster recovery and other data management and movement processes.

At a time of budgetary pressures, sufficient resources may not be available to meet these challenges. If this occurs, bottlenecks may develop in collection, distribution and exploitation of information. Critical data protections may be eroded. Risks of organizational disruption may increase. The business impact of such effects may be substantial.

From this perspective, there is a clear business case for greater infrastructure efficiency. Users interact with, and business processes are enabled by SAP application solutions. Infrastructures are merely the delivery mechanisms for these. Reducing infrastructure costs allows organizations to channel greater IT resources into tasks that contribute more directly and substantively to realization of business advantage.

A second reason to pay attention to underlying infrastructures is that, at least in the areas addressed in this report, the same mechanisms that reduce costs also boost performance and/or reduce risk. Efficiency improves both sides of the cost/benefit equation.

Key Variables

Overview

In comparing the cost implications of Oracle Database 11g and DB2 9.7 technologies for SAP deployment, five variables emerge as particularly significant: performance accelerators, data compression, automation, use of the SAP NLS Solution and clustered architectures.

These capabilities are to some extent interdependent. For example, compression may not only reduce costs, but also boost server, storage and network performance.

Similarly, although the most visible effect of automation is in improved administrator productivity, it may improve performance and capacity utilization (systems whose parameters are continuously and automatically adjusted use resources more efficiently than those dependent upon manual intervention) and availability, data integrity and security (there is less risk of human error).

A broader variable also deserves attention – the extent to which capabilities are integrated, and configurations are optimized, to support SAP environments. Experience has shown that effective tuning can materially increase system performance and reduce risks of failures and bottlenecks. Few would dispute that DB2 9.7 is – by wide margins – more advanced than Oracle Database 11g in this respect.

Performance Accelerators

Although there has been a great deal of industry experience in quantifying Oracle Database 10g and DB2 9.7 performance, this is not the case for Oracle Database 11g.

At the time of writing, Oracle Database 11g had been generally available for SAP for just over a year, and user production experience was limited. Users had reported that while Oracle compression had improved, overall performance gains were more difficult to quantify. The impact of capabilities such as the Database 11g Partitioning Engine and SecureFiles appears to have been more incremental than radical.

A year after Oracle Database 11g was certified by SAP, no SAP SD two-tier benchmark results had been released – the most recent Oracle benchmarks were published in December 2009, and were for Oracle Database 10g. In comparison, over the same period IBM has published results for nine DB2 9.7 benchmarks on a variety of IBM Power and System x (Intel-based) platforms.

Distinctive DB2 9.7 features accelerate SAP performance. In SAP BI environments, for example, key accelerators include DB2 Database Partitioning Feature (DPF) and Multi-Dimensional Clustering (MDC). SAP BI users employing DB2 9.7 have experienced improvements of up to eight to nine times in performance for processes involving repetitive queries, large tablespaces, or both.

Data Compression

Data compression can deliver a variety of cost savings and performance improvements. Although savings in disk capacity tend to be most visible, compression effects can extend across all phases of data movement cycles. Faster I/O throughput translates into higher performance – particularly for I/O-intensive applications – and data load, backup and replication times are typically reduced.

Potential savings extend to processor, memory and I/O capacity for database servers; tape systems, drives and media; and network bandwidth consumption. The effects of reduced bandwidth consumption tend to be particularly significant for remote real-time replication processes employed for disaster recovery.

In addition, because software products for point-in-time copy, remote replication and recovery, backup, storage management and related functions are commonly priced on a per terabyte basis, savings may be realized in license and support fees for these. Smaller configurations also typically result in lower facilities costs for data center occupancy, power and cooling costs.

In Oracle Database 10g, compression capabilities were limited to indexes and backup processes, which had little impact of overall cost structures and performance levels. In Oracle Database 11g, however, SAP-certified support is provided for Advanced Compression, which extends compression to online transaction processing (OLTP) database tables and reengineers key Oracle data structures.

Advanced Compression offers SAP users the potential for higher compression levels than could be realized using Oracle 10g. But, the extent of improvements that may be realized in practice is still unclear.

Oracle test results have shown disk space savings of up to 60 to 65 percent. Such results, however, are not necessarily representative of what users will experience.

Early indications are that Advanced Compression gains must be qualified. This technology appears to work best when databases are highly structured, and undergo few changes over time. In more dynamic environments, compression effects tend to be less pronounced, and to erode over time unless frequent database reorganizations are conducted – which may not be feasible for many users.

Although uncertainties remain as to the effects of Advanced Compression, there is little doubt that its capabilities still fall well short of those of DB2 9.7. Compression algorithms are significantly more powerful than Oracle Database 11g equivalents, extending to permanent as well as temporary tables, indexes, log files, large objects (LOBs), values, XML data and other data structures.

DB2 9.7 compression is, moreover optimized for use in a SAP environment. It has been a major focus of SAP and IBM joint development activities for more than seven years, and has been reflected in progressively tighter integration through all major DB2 versions. Oracle Database 11g Advanced Compression integration with and optimization for SAP environments is substantially less.

Automation

Automation is a longstanding DB2 strength. Key features, including those shown in figure 4, draw upon IBM autonomic technologies.

Automatic Storage Management	**Automatic/Real-Time Statistics Collection**
Self Tuning Memory Manager (STMM)	**Health monitoring**
Automatic Reorganization	**Workload Manager**
Automatic Backup	**Silent installation**

Figure 4: ***Major DB2 Autonomic Features Supported for SAP Environments***

Autonomic computing, meaning the application of advanced artificial intelligence technologies to IT administration and optimization tasks, has been a major IBM development focus for more than a decade. The company is the recognized industry leader in this area.

These and other DB2 automation features have been specifically optimized for SAP environments. Auto-tuning capabilities, for example, draw upon high levels of SAP configuration and workload awareness, which means that tuning and configuration management tasks that require manual intervention in Oracle installations are in many cases handled directly by DB2 9.7.

These and other DB2 features are accessible through the SAP DBA Cockpit. Although Oracle Database 11g and other databases also support use of this interface, DB2 capabilities provide differentiated value.

The DB2 Workload Management solution for SAP, for example, is a mainframe-derived feature that provides one of the industry's most effective tools for business-driven prioritization and service level management of database workloads. Enhanced DB2-specific monitoring functions are also provided for the Performance Warehouse component of DBA Cockpit.

DB2 silent installation, described earlier, may also reduce the amount of time and effort required for SAP solution upgrades. Silent installation allows DB2 to be automatically configured for customer-specific SAP systems during installation of these. Development, test, quality assurance and other non-production instances are generated automatically from production systems.

Clustered Architectures

Although Oracle RAC has been supported for SAP environments since 1992, it has not been widely adopted by SAP users. Most RAC deployments have been in relatively small SAP installations. Implementation complexities, performance issues and the availability of simpler, less expensive Oracle HA solutions such as Clusterware and Data Guard have contributed to this situation.

DB2 pureScale positioning is more promising. In contrast to RAC, applications can be migrated "as is". Additionally, there is the possibility that it will enjoy the same appeal among large SAP users as mainframe Parallel Sysplex Data Sharing architecture, upon which it is based.

DB2 pureScale employs the IBM General Parallel File System (GPFS) high-performance, shared-disk file management solution on IBM Power servers with the AIX operating system, and on IBM System x servers with the x86 version of SUSE Linux Enterprise Server (SLES).

Parallel Sysplex is employed by some of the world's largest mainframe users for their most business-critical applications. It is recognized as a world leader in ensuring continuous availability. Production clusters routinely run from 2 to 10 nodes, and many are in the 10- to 20-node range.

(One of the main reasons why clusters of this size have become common is that they enable higher overall levels of capacity utilization. Users have found that workloads supported in, say, a three-way cluster may be significantly larger than those could run on the same three systems operating in standalone mode.)

A wide area extension, Geographically Dispersed Parallel Sysplex (GDPS), is recognized as the IT industry's premier solution for high-volume remote failover and recovery. Users have reported that, even for large sites, a planned site switch typically requires less than 45 minutes (including network propagation delays) and recovery from an unplanned site outage, less than 60 minutes.

GDPS allows transparent integration of IBM's high-end Metro Mirror (synchronous) and Global Mirror (asynchronous) solutions for real-time replication and failover of storage systems.

Geographically Dispersed DB2 pureScale Clusters (GDPC) provide comparable functionality.

NLS Solution

SAP NetWeaver BW Near-Line Storage (NLS) solution provides interfaces enables users to employ lower-cost disk drives for portions of SAP NetWeaver BI databases.

The solution creates a category of less frequently exploited data that can be placed on lower-performance SATA or SAS drives, but which – unlike archived data – remains directly accessible to analytical and extract, transformation and load (ETL) processes.

A key feature of the NLS solution is that it enables extremely high levels of data compression – according to SAP, up to 95 percent. Reduced data volumes, along with the ability to use low-end or midrange disk hardware and software, can translate into major cost savings for organizations employing large BI systems. This is particularly the case where BI databases are experiencing high levels of growth.

The SAP NLS solution was until recently been supported only by smaller, specialist hardware and software suppliers. IBM is the first major vendor to provide database-level support. The IBM DB2 Near-Line Storage Solution for SAP NetWeaver BW, which became available in late 2009, enables organizations to offload BI data onto any DB2-supported disk system or media.

Users of the IBM NLS solution have experienced compression rates of 60 to 70 percent where BI databases were uncompressed, and an additional 10 to 15 percent where they were already compressed.

Even higher levels of data reduction may be achieved for archive databases using data deduplication tools such as the IBM System Storage TS7650 ProtecTIER Deduplication Appliance and TS7650G Deduplication Gateway.

The IBM NLS solution supports key DB2 capabilities including Automatic Storage, Self Tuning Memory Management (STMM), Database Partitioning Feature and Multi-Dimensional Clustering, and may be monitored and managed using DB2 tools accessible through the SAP DBA Cockpit. In practice, it may be managed transparently as a component of the primary BI system.

HANA Enablement

DB2 is also enabled for use with the SAP High-Performance Analytic Appliance (HANA), an SAP-designed solution that employs in-memory database technology to enable "real-time" analysis. HANA is designed for use in applications in which data is extracted directly from operational systems and analyzed in a matter of seconds or minutes.

HANA, which became generally available in July 2010, was developed by SAP in cooperation with Hewlett-Packard, IBM, Intel and other hardware vendors. The IBM HANA offering, Systems solution for SAP HANA, includes options built around two- to eight-socket System x servers equipped with the latest generation of IBM X-Architecture, Intel Xeon E7 processors and solid state devices (SSDs).

In March 2011, SAP and IBM announced that DB2 had been integrated with HANA. In this role, DB2 is enabled for extremely high-speed replication of large volumes of data from SAP ERP and/or other operational systems to HANA systems.

SAP and IBM have published results from a benchmark test using DB2 and a System x-based HANA configuration. The system was able to process 10,000 complex queries per hour on 1.3 terabytes (TB) of data in SAP ERP tables while completing individual calculations in a matter of seconds.

DETAILED DATA

Basis of Calculations

Overview

The cost comparisons presented in this report were developed using a three-phase approach. First, three composite profiles of SAP installations in manufacturing companies were prepared.

Second, scenarios were developed for use of Oracle Database 11g and DB2 9.7 in each installation. Allowance was made for differences in database, disk and tape system configurations, and in staffing levels due to capability differences discussed earlier. Third, three-year costs were calculated for baseline as well as migration comparisons, and transition costs were added to DB2 9.7 scenarios for the latter.

Installations

Installation profiles are summarized in figure 5.

	Industrial Machinery Company	High-Tech Company	Aerospace Company
Business Profile	$7 billion 35,000 employees Manufacturer of industrial machinery, tools & parts; maintenance services 50 major production & distribution centers	$5 billion 25,000 employees Manufacturer of electronic systems, components & subassemblies 12 production sites; 20+ development facilities	$6 billion 15,000 employees Manufacturer & integrator of aviation & defense systems 12 major facilities
SAP Suite	SAP for Industrial Machinery & Components	SAP for High Tech	SAP for Aerospace & Defense
Number of Users	5,600+	3,500+	2,000+

Figure 5: ***Installations Summary***

All installations include SAP Enterprise Resource Planning (ERP), Business Intelligence (BI), Customer Relationship Management (CRM), Product Lifecycle Management (PLM), Supply Chain Management (SCM), Supplier Relationship Management (SRM) as well as other SAP and partner solutions. The Industrial Machinery and High-Tech companies also employ SAP BusinessObjects applications.

Installation data and calculations are for production as well as development, test, quality assurance and other instances of these.

Installations were constructed using data on applications, databases, user populations, workloads, storage bases, database and storage administration staffing, and other variables supplied by 20 companies in the same industries and approximate size ranges, with generally similar business profiles.

Because few large companies have deployed entire suites of latest-generation SAP solutions, and to protect the confidentiality of individual organizations, a best practices approach drawing upon the experiences of multiple users was employed.

In constructing the high-tech company installation, for example, the experiences of one company with SAP ERP and CRM systems were combined with those of a second with BI, PLM and SCM applications, and others with SAP xApps.

Scenarios

Oracle Database 11g scenarios for each installation represent baselines for calculations. For DB2 9.7 scenarios, configurations and staffing levels were reduced using the following values:

- ***Data compression***. Calculations assume a DB2 9.7 compression rate of 35 percent relative to Oracle Database 11g. Compression affects calculations for disk and tape system capacities, tape media consumption and administration staffing.

- ***Database-related staffing***. Calculations assume a 20 to 33 percent lower FTE headcount, depending on database, application and workload characteristics and rates of change, in DB2 9.7 scenarios for database-related tasks performed by database and Basis administrators.

These values assume that database, server and storage resources for Oracle Database 11g as well as DB2 9.7 scenarios are configured and managed in an efficient, best practice manner.

Configurations

Configurations were developed as follows:

- ***Databases***. Configurations are for use of Oracle Database 11g or DB2 9.7 for all systems. Scenarios for both platforms include management and support tools offered by SAP without additional charge.

- ***Disk systems***. The companies upon which installations were based employed a variety of disk systems and software from EMC, Hewlett-Packard, Hitachi Data Systems, IBM and others.

  To ensure comparability of results, these were translated into configurations of current-generation IBM DS8800 or Storwize V7000 systems based on installed capacity in terabytes and on required performance characteristics for specific applications or groups of applications. Systems were equipped with 600-gigabyte (GB) SAS drives.

  V7000 systems were employed for applications that were less sensitive to performance, availability or both. For NLS applications in DB2 9.7 scenarios, SAN-attached IBM DS3500 systems equipped with 2TB near-line SAS drives were employed

  In calculating costs of disk systems, allowance was made for capacity growth rates of from 7 to 18 percent per year, depending on applications, for the industrial machinery company; from 15 to 45 percent for the high-tech company; and from 10 to 35 percent for the aerospace company. Configurations were upgraded accordingly over three-year calculation period.

  In translating other vendors' systems to DS8800 and V7000 models, and in allowing for growth, configurations were rounded to the next largest capacity increment offered for these platforms.

  DS8800 systems were equipped with IBM software products employed for point-in-time-copy (FlashCopy) and, where appropriate, business continuity (Global Mirror or Metro Mirror), along with the Tivoli Storage Productivity Center (TPC) management suite.

  V7000 systems were configured with V7000 software and TPC suites, and DS3500 systems employed in DB2 scenarios with FlashCopy software.

- ***Tape systems***. The companies upon which installations were based employed a variety of tape storage systems. These were translated, based on capacity and throughput requirements, into current-generation IBM TS3500 Tape Library systems employing Linear Tape Open Ultrium Generation 5 (LTO-5) drives and 1.5TB cartridges.

  Systems were configured based on size of backup data volumes, and on required frequency and duration of backup operations. It was assumed that companies conducted daily incremental, weekly differential and monthly full backups; and that tapes intended for long-term retention were stored at secure offsite locations.

  Allowance was made for growth in backup volumes over a three-year period. These generally paralleled the capacity growth rates for disk systems cited above.

Configurations and staffing levels for Oracle Database 11g and DB2 9.7 scenarios are summarized in figures 6 and 7 respectively.

Industrial Machinery Company	High-Tech Company	Aerospace Company
DISK SYSTEMS		
Initial Configuration		
1 x DS8800 x 38.4TB 1 x DS8800 x 28.8TB *Global Mirror, FlashCopy, TPC* 1 x V7000 x 36TB 1 x V7000 x 28.8TB *FlashCopy, TPC*	2 x DS8800 x 57.6TB *Metro Mirror, FlashCopy, TPC* 1 x DS8800 x 48TB 1 x V7000 x 43.2TB 1 x V7000 x 36TB *FlashCopy, TPC*	1 x DS8800 x 38.4TB 1 x DS8800 x 28.8TB *Global Mirror, FlashCopy, TPC* 1 x V7000 x 28.8TB 1 x V7000 x 21.6TB 1 x V7000 x 14.4TB *FlashCopy, TPC*
End of Period Configuration		
1 x DS8800 x 43.2TB 1 x DS8800 x 38.4TB *Global Mirror, FlashCopy, TPC* 2 x V7000 x 43.2TB *FlashCopy, TPC*	2 x DS8800 x 115.2TB *Metro Mirror, FlashCopy, TPC* 1 x DS8800 x 105.6TB 1 x V7000 x 72TB 1 x V7000 x 36TB 1 x V7000 x 14.4TB *FlashCopy, TPC*	1 x DS8800 x 57.6TB 1 x DS8800 x 48TB *Global Mirror, FlashCopy, TPC* 2 x V7000 x 43.2TB 1 x V7000 x 36TB *FlashCopy, TPC*
TAPE SYSTEMS		
Initial Configuration		
TS3500 6 x LTO-5	TS3500 9 x LTO-5	TS3500 6 x LTO-5
End of Period Configuration		
TS3500 9 x LTO-5	TS3500 17 x LTO-5	TS3500 12 x LTO-5
PERSONNEL		
Initial Staffing		
3.75 FTEs	5.65 FTEs	4.05 FTEs
End of Period Staffing		
3.95 FTEs	6.45 FTEs	4.5 FTEs

Figure 6: ***Configurations and Staffing Summary – Oracle Database 11g Scenarios***

Industrial Machinery Company	High-Tech Company	Aerospace Company
DISK SYSTEMS		
Initial Configuration		
1x DS8800 x 28.8TB 1 x DS8800 x 19.2TB *Metro Mirror, FlashCopy, TPC* 1 x V7000 x 28.8TB *V7000 Software, TPC* 1 x DS3500 x 4TB *FlashCopy*	2 x DS8800 x 38.4TB *Metro Mirror, FlashCopy, TPC* 1 x V7000 x 36TB 1 x V7000 x 28.8TB *V7000 Software, TPC* 1 x DS3500 x 12TB *FlashCopy*	2 x DS8800 x 28.8TB *Global Mirror, FlashCopy, TPC* 1 x V7000 x 21.6TB 1 x V7000 x 14.4TB *V7000 Software, TPC* 1 x DS3500 x 6TB *FlashCopy*
End of Period Configuration		
2 x DS8800 x 28.8TB *Metro Mirror, FlashCopy, TPC* 1 x V7000 x 50.4 TB *V7000 Software, TPC* 1 x DS3500 x 6TB *FlashCopy*	2 x DS8800 x 86.4TB *Metro Mirror, FlashCopy, TPC* 1 x DS8800 x 67.2TB 1 x V7000 x 50.4TB *V7000 Software, TPC* 1 x DS3500 x 24TB *FlashCopy*	2 x DS8800 x 38.4TB *Global Mirror, FlashCopy, TPC* 2 x V7000 x 36TB *V7000 Software, TPC* 1 x DS3500 x 8TB *FlashCopy*
TAPE SYSTEMS		
Initial Configuration		
TS3500 4 x LTO-5	TS3500 6 x LTO-5	TS3500 4 x LTO-5
End of Period Configuration		
TS3500 6 x LTO-5	TS3500 12 x LTO-5	TS3500 8 x LTO-5
PERSONNEL		
Initial Staffing		
2.85 FTEs	3.7 FTEs	2.75 FTEs
End of Period Staffing		
3.0 FTEs	4.15 FTEs	3.0 FTEs

Figure 7: ***Configurations and Staffing Summary – IBM DB2 9.7 Scenarios***

Cost Values

The following cost values were employed:

- ***Database costs***. For baseline scenarios, calculations were based on initial license costs of 15 and 8 percent of SAV totals for each installation for Oracle Database 11g and DB2 9.7 respectively. Support costs were calculated for SAP Enterprise Support at 22 percent of SAV per year.

  For migration scenarios, Oracle Database 11g costs are for support only. DB2 9.7 costs include licenses and support, allowing for IBM migration pricing incentives, along with planning, analysis, data conversion, testing, tuning, verification and other migration-related activities performed by specialist IBM and/or SAP personnel.

  Migration-related costs were calculated based on database sizes and functional characteristics for each major application or group of applications. DB2 9.7 totals also include staff retraining costs, including classes, as well as travel and lodging expenses for customer personnel.

- ***Storage costs***. Costs include hardware and software acquisition, as well as hardware maintenance and software support. Costs of IBM Operating Environment Licenses (OEL) for DS8800 systems are included in hardware costs.

Hardware maintenance costs, as well as support costs for FlashCopy, Global Mirror and Metro Mirror software for DS8800 systems were calculated based on four-year warranty options offered by IBM. Calculations for all other IBM hardware and software products assume standard warranties. All maintenance and software support costs are for 24/7 coverage.

(IBM refers to ongoing software support as Software Subscription and Support. However, because SAP prefers the term "software support," this is employed throughout this report.)

Costs for tape systems include costs for acquisition, handling and secure storage of cartridges. All costs were calculated using discounted street prices.

- ***Personnel costs***. These were calculated using annual average salaries of U.S. $99,842 and $97,235 per year for Oracle Database 11g and DB2 9.7 database administrators respectively, and $86,318 for Basis administrators for both platforms. All salaries were increased by 51.2 percent to allow for benefits, bonuses, training and related items.

- ***Facilities costs***. These were calculated for all platforms using IBM specifications. Calculations include costs for data center occupancy, power and cooling as well as allowance for acquisition, maintenance and operational costs for data center infrastructure equipment including uninterruptable power supplies (UPS), power distribution systems (PDS) and chillers. Costs for these were calculated based on prorated values per kilowatt-hour (kWh).

  Power, cooling and support equipment costs were calculated based on average utilization levels (e.g., 30 percent, 70 percent) for systems and servers supporting production as well as non-production instances, and for average annual hours of operation for these. All calculations employed values based on data supplied by companies upon which installations were based.

  Support equipment costs include allowance for growth in power and cooling requirements over the five-year measurement period. Acquisition and maintenance costs were calculated using appropriate street price values.

  Occupancy 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), while power costs were calculated using a conservative assumption for average price per kWh.

All costs are for the United States.

Cost Breakdowns

Cost breakdowns for Oracle Database 11g and DB2 9.7 scenarios are presented in figures 8 and 9.

	Industrial Machinery Company	High-Tech Company	Aerospace Company
DATABASES (BASELINE COMPARISONS)			
Total ($000)	4,546.8	4,387.3	3,366.1
DATABASES (MIGRATION COSTS COMPARISONS)			
Total ($000)	1,807.7	1,744.3	1,338.3
DISK SYSTEMS			
Hardware + OEL	1,738.3	5,171.4	2,581.6
Hardware maintenance	10.5	16.0	14.5
Software licenses	1,159.3	2,837.4	1,797.72
Software support	65.8	118.2	131.76
Total ($000)	**2,974.0**	**8,143.0**	**4,525.6**
TAPE SYSTEMS			
Hardware	114.4	193.7	156.4
Hardware maintenance	47.6	82.6	60.6
Media	146.9	301.8	214.6
Total ($000)	**308.9**	**578.1**	**431.6**
FACILITIES			
Total ($000)	**140.8**	**400.8**	**217.3**
PERSONNEL			
Total ($000)	**1,569.4**	**2,457.8**	**1,738.7**
TOTAL THREE -YEAR COSTS (BASELINE COMPARISONS)			
TOTAL ($000)	**9,539.8**	**15,967.0**	**10,279.2**
TOTAL THREE-YEAR COSTS (MIGRATION COSTS COMPARISONS)			
TOTAL ($000)	**6,800.7**	**13,324.0**	**8,251.4**

Figure 8: ***Three-year Cost Breakdowns – Oracle Database 11g Scenarios***

	Industrial Machinery Company	High-Tech Company	Aerospace Company
DATABASES (BASELINE COMPARISONS)			
Total ($000)	**2,424.9**	**2,339.7**	**1,795.2**
DATABASES (MIGRATION COSTS COMPARISONS)			
Total ($000)	**1,656.8**	**1,851.5**	**1,289.4**
DISK SYSTEMS			
Hardware + OEL	1,111.9	3,681.5	1,279.0
Hardware maintenance	17.8	21.8	11.3
Software licenses	774.7	2,544.6	900.1
Software support	35.7	90.0	31.3
Total ($000)	**1,940.1**	**6,337.9**	**2,221.7**
TAPE SYSTEMS			
Hardware	76.3	182.4	104.2
Hardware maintenance	29.5	82.9	42.3
Media	93.0	217.3	163.0
Total ($000)	**198.8**	**482.6**	**309.5**
FACILITIES			
Total ($000)	**98.3**	**266.5**	**146.9**
PERSONNEL			
Total ($000)	**1,191.4**	**1,594.5**	**1,162.9**
TOTAL THREE -YEAR COSTS (BASELINE COMPARISONS)			
TOTAL ($000)	**5,853.5**	**11,021.2**	**5,636.2**
TOTAL THREE-YEAR COSTS (MIGRATION COSTS COMPARISONS)			
TOTAL ($000)	**5,085.4**	**10,533.0**	**5,130.4**

Figure 9: Three-year Cost Breakdowns – IBM DB2 9.7 Scenarios

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