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MANAGEMENT BRIEF

VALUE PROPOSITION FOR IBM DB2 9

Cost/Benefit Case for SAP Enterprise Migrations

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EXECUTIVE SUMMARY

Choices

What is the future of SAP in large organizations?

Over the next few years, most ERP users will begin to move beyond application-by-application deployment of SAP ERP 6.0 solutions to large-scale migrations of core enterprise systems. If experience is any guide, the lifecycle of these systems will be from 10 to 15 years. The next round of decisions about SAP deployment will be among the most important that today's executives will ever make.

What options are available? For most organizations, migration to another vendor's enterprise resource planning (ERP) systems would be neither realistic nor desirable. The choice of a core database platform is, however, an open option. For many users, it will be – at least from a technological perspective – the most important variable of future SAP evolution in their organizations over which they have control.

Database choices will materially affect the structure and functionality of next-generation SAP enterprise environments, the technical complexities with which organizations must deal, and the effectiveness with which information may be used as a new source of business advantage. There are also major cost implications, which are the focus of this report.

Specifically, this report examines the cost implications of employing Oracle 10g or IBM DB2 9 to support SAP ERP 6.0 solutions. It is based on input from numerous SAP users.

It will come as no surprise that DB2 9 costs less than Oracle 10g. There are significant differences in license costs for the two platforms as a percentage of SAP Application Value (SAV). This, however, proves to be only part of the picture.

If allowance is made for DB2 9 performance, compression and automation capabilities, a broader set of differences emerge. Cost reductions occur not only in database software, but also in database servers, disk and tape storage systems, and database- and storage-related administrative processes. These savings more than offset costs of large-scale migration from Oracle to DB2 9.

Costs

Cost Comparisons

The cost comparisons presented in this report are based on three composite profiles of large-scale SAP ERP installations in three companies: an $8 billion manufacturer of industrial machinery, tools and parts; a $5 billion manufacturer of electronic systems, components and subassemblies; and a $3 billion automotive parts manufacturer.

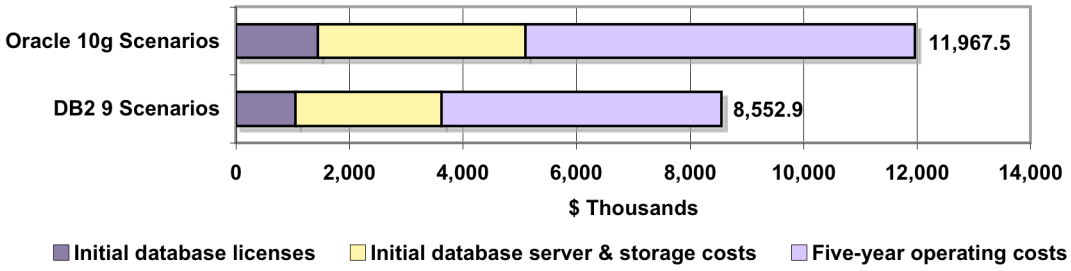
For each profile, scenarios were developed for use of Oracle 10g and DB2 9, and three sets of costs were calculated: initial investments in databases, database servers and storage infrastructures; five-year operating costs for these; and costs of Oracle to DB2 9 migration, including data conversion, system set-up and staff retraining.

Results may be summarized as follows:

- ***Baseline costs comparison***. If it is assumed that companies are deploying SAP ERP solutions for the first time and that no database migration occurs, combined initial investment and five-year ongoing costs for DB2 9 scenarios for the three installations average 28.5 percent less than those for Oracle equivalents.

  Results are illustrated in figure 1.

Figure 1
Baseline Costs Comparison: Averages for All Installations



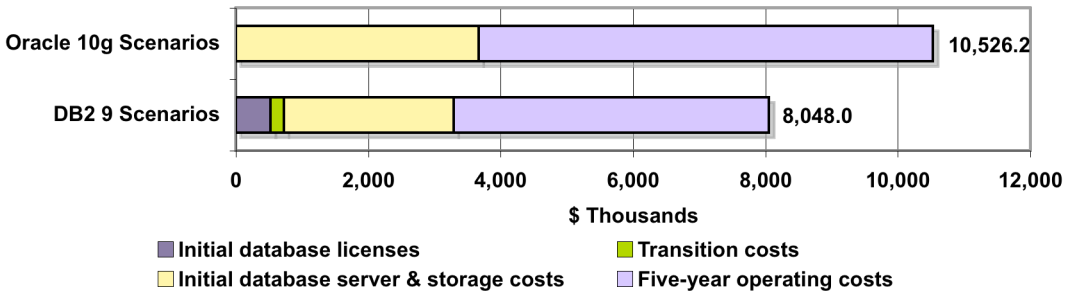
  In this comparison, costs for Oracle 10g and DB2 9 scenarios include acquisition of initial database licenses as well as database servers, and disk and tape storage systems. It is assumed that companies put in place entire new infrastructures of database servers and storage systems to support SAP deployments.

  Five-year operating costs include subsequent hardware and software acquisitions required to handle workload growth, along with hardware maintenance, software support, facilities (primarily power and cooling), database and storage administration personnel, and other recurring items.

- ***Migration comparison (1)***. If it is assumed that companies initially employ Oracle 10g but migrate to DB2 9, combined costs for DB2 9 scenarios for the three installations average 23.5 percent less than those for Oracle 10g equivalents.

  Results are illustrated in figure 2.

Figure 2
Migration Comparison (1): Cost Averages for All Installations



  In this calculation, it is again assumed that companies put in place entire new infrastructures of database servers and storage systems to support SAP deployments.

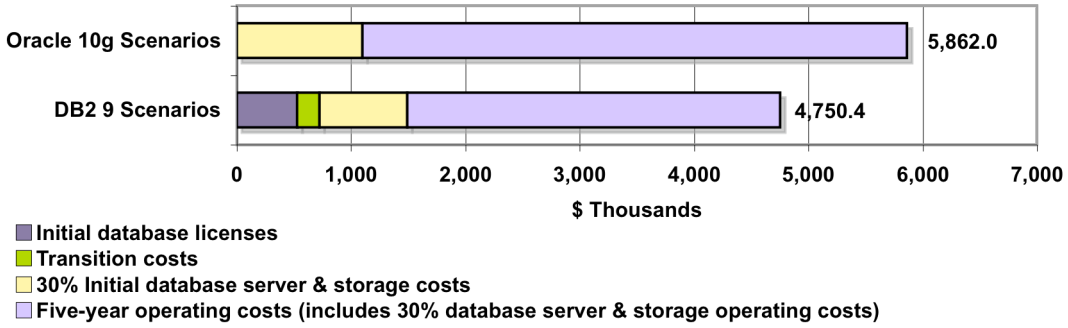
Oracle scenarios do not include initial database license costs, while DB2 9 scenarios include initial database license costs as well as transition costs, including data conversion and staff retraining. Allowance is made for special IBM pricing for Oracle to DB2 9 migration projects. All other costs are as for the previous comparison.

- ***Migration comparison (2)***. In this comparison, it is assumed that companies build upon existing database server and storage systems, but invest in some additional capacity to support SAP deployments. Calculations include 30 percent of initial as well as of five-year operating costs for database servers and storage systems. All other costs are as for the previous comparison.

  Combined costs for DB2 9 scenarios for the three installations average 19.0 percent less than those for Oracle 10g equivalents.

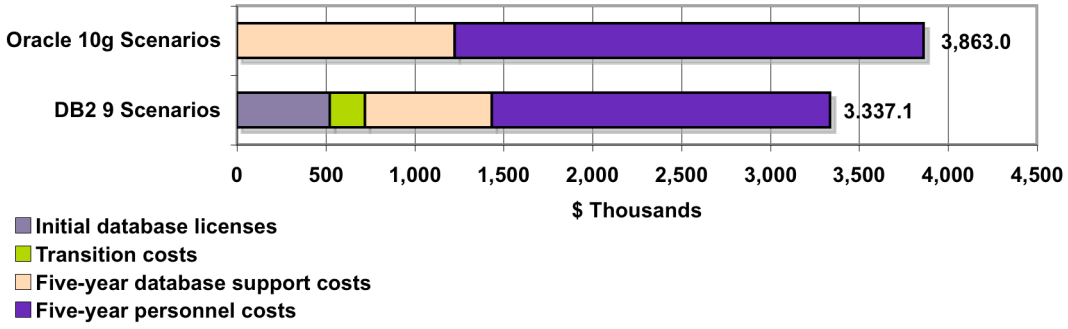
  Results are illustrated in figure 3.

Figure 3
Migration Comparison (2): Cost Averages for All Installations



- ***Migration comparison (3)***. In this comparison, it is assumed that no database server or storage system upgrades occur. Results summarized in figure 4 include only database software and personnel costs. Combined costs for DB2 9 scenarios average 13.6 percent less than those for Oracle 10g equivalents.

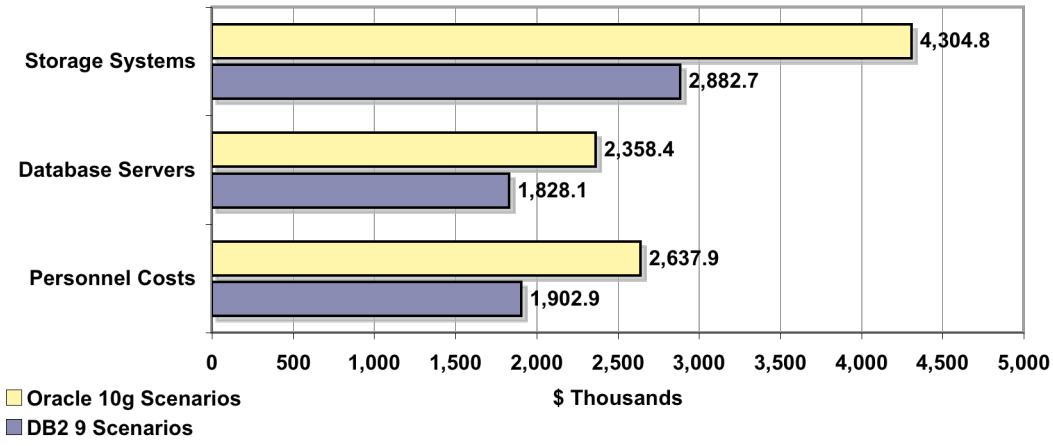
Figure 4
Migration Comparison (3): Cost Averages for All Installations



- ***Database server, storage system and personnel costs***. In DB2 9 scenarios, costs for database servers and storage systems are reduced by DB2 9 compression capabilities, performance enhancements and other features optimized for SAP ERP environments. More effective automation of key database, storage configuration and administration tasks also results in lower personnel costs.

Figure 5 illustrates disparities in these areas.

Figure 5
Database Server, Storage System and Personnel Costs for Oracle 10g and DB2 9 Scenarios: Averages for All Installations



In this calculation, it is assumed that companies put in place entire new infrastructures of underlying platforms. Compared to Oracle 10g scenarios, combined initial and five-year operating costs for DB2 9 scenarios average 33.0 percent less for storage systems and 22.5 percent less for database servers. Personnel costs average 27.9 percent less.

In all calculations, software and hardware acquisition, maintenance and support costs were calculated based on discounted "street" prices (i.e., prices actually paid by users). Personnel and facilities costs were calculated based on U.S. norms. Additional information on profile installations, along with granular cost breakdowns and details of cost assumptions and methodologies may be found in the following section.

These comparisons are specific to the profile installations, assumptions and methodologies upon which calculations are based. Costs experienced by individual users may differ widely, depending upon organization size, business profile, application portfolios, database sizes and structures, workload characteristics, user demographics, growth patterns and other variables.

Database server and storage platform choices may also materially affect costs. Calculations undertaken for this report are based on the use of latest-generation IBM POWER6-based System p 570 servers, DS8100 Turbo disk systems, TS3500 tape systems with LTO-4 technology, and IBM software suites supporting these. Costs may vary significantly if other platforms and software tools are employed.

Additional, separately charged Oracle tools may be required to provide functionality equivalent to DB2 for SAP environments. Oracle costs may be further increased if standby servers are employed.

Whatever the actual cost picture may be for individual users, one conclusion may reasonably be drawn: the costs of moving to DB2 9 do not represent a serious obstacle to the adoption of a new corporate database standard for SAP ERP 6.0 environments. Which means that attention may be focused on other, potentially more important issues.

Decisions

In preparing this report, input was obtained from nine organizations in Europe and North America that had migrated SAP ERP environments from Oracle to DB2 9 databases, or were in the process of doing so. It was found that, in all cases, potential cost savings contributed to migration decisions. This was not, however, an exclusive consideration.

Organizations also cited SAP's commitment to DB2 9, and the close relationship between IBM and SAP in database development and optimization as equally if not more important than cost savings. DB2 9, it was noted, is SAP's "preferred and recommended" database for its ERP 6.0 generation of solutions. The close relationship between SAP and IBM was also seen as reducing the risks associated with implementation and long-term operation of large-scale SAP environments.

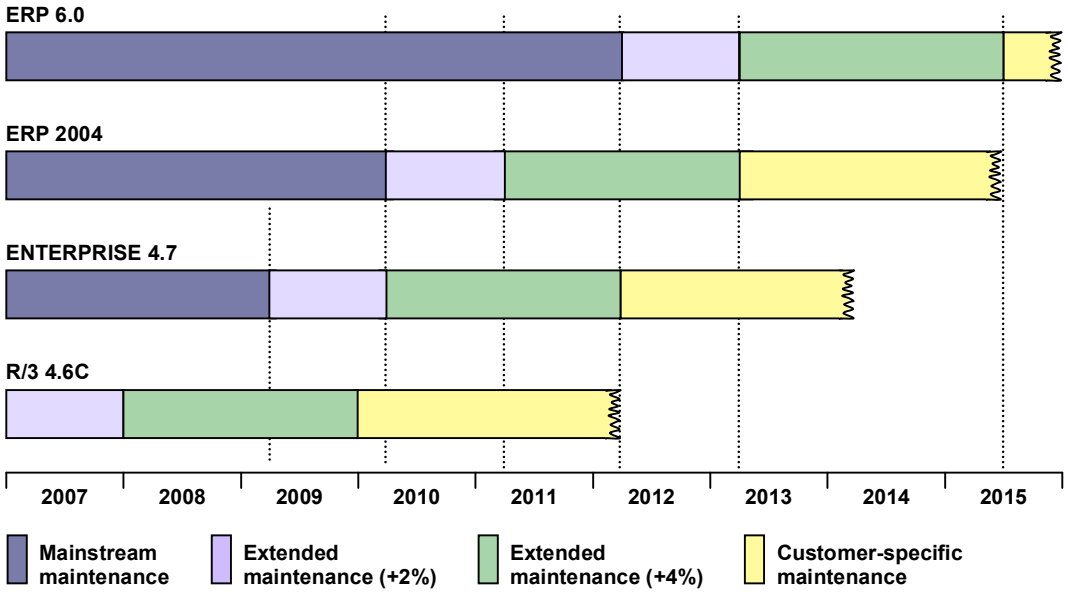
Decision-makers were aware that they would be committing their organizations to solutions that, for at least 7 and probably more than 10 years, would have a pervasive impact on business efficiency and competitiveness. If structural flaws or inefficiencies became embedded within SAP environments, or within infrastructures supporting them, the bottom-line impact might be both serious and long lasting.

There was also widespread awareness that the technical challenges posed by ERP 6.0 solutions were significantly different from those SAP users had faced in the past. Next-generation environments would be less structured and technologically more diverse, and technical standards would be less precisely defined than was the case for SAP R/3 and SAP Enterprise 4.7 systems.

This made it particularly important that organizations should be able to control technical complexities, and that the future evolution of their ERP 6.0 environments should be both predictable and manageable. From both perspectives, the agreement between SAP and IBM to coordinate future upgrade and maintenance schedules yielded key benefits.

Organizations would be obliged to plan based on SAP's strategic product and maintenance schedule. If database upgrade and support cycles were not consistent with this schedule, which is illustrated in figure 6, cost and complexity would be added to the process of maintaining ERP 6.0 currency. Implementation schedules could also be disrupted, delivery of new application functionality could be delayed or impaired, or both could occur.

Figure 6
SAP Strategic Product and Maintenance Schedule



Another consideration was that ERP 6.0 enterprise environments would be functionally broader and technologically more sophisticated than earlier SAP equivalents. For example, while SAP R/3 deployments tended to focus on transactional processes, ERP 6.0 solutions deliver a wider range of high-value informational and collaborative capabilities to new user communities.

The implications are important. More than a decade of experience has demonstrated that organizations that deploy ERP systems become fundamentally dependent upon them. With next-generation solutions, that dependence will increase significantly. The consequences of embedded flaws and inefficiencies will be correspondingly greater.

Among organizations that had decided to migrate from Oracle to DB2 9 for enterprise-class ERP 6.0 deployments, awareness of these risks – and a desire to mitigate them – was a major factor in their decisions. The prevailing view was that commitment to DB2 9 materially reduced risk exposure. It is difficult to fault their logic.

COST PICTURE

Cost Levels

For more than a decade, the costs of deploying and supporting SAP solutions have been the subject of a great deal of industry debate. This has occurred at multiple levels.

At the highest level, discussions of IT costs have been subsumed into larger debates about comparative business contribution, competitive performance and related themes. The focus has been on the overall costs of the SAP environment, including application deployment, development and support outlays, and on the extent to which these may be correlated with tangible indicators of business gain. These subjects have been addressed through the SAP Total Cost of Ownership (TCO) Framework.

A second level of discussion has revolved around the effects of such variables as consolidation, customization and best practices on overall cost structures for SAP systems. These subjects tend to be technology-independent. Consolidation of system and database instances, implementation of shared services structures, best practices initiatives and the like tend to yield gains regardless of which underlying platforms are employed.

The third level of discussion has been about what may be characterized as "infrastructure costs," meaning the costs of acquiring, operating, administering and maintaining underlying databases, servers, storage, and systems software platforms. This subject, to a large extent, can be addressed independently.

This report deals with infrastructure costs. A stronger focus on these is, arguably, long overdue. They represent a major component of overall cost structures for SAP users. If infrastructure costs can be materially reduced without impairing system performance and functionality, there is no obvious reason not to do so.

Users interact with, and business processes are automated by SAP application solutions. Underlying infrastructures are merely the delivery mechanisms for these. If infrastructure costs are reduced, organizations may better focus their resources on application- and process-related tasks that contribute more substantially to the realization of business advantage.

Efficiency, as much at the infrastructure level as for the business as a whole, creates value.

Database Infrastructures

Cost Variables

Databases are the core of any SAP environment. The infrastructures that support these – including database software and servers, storage systems, and personnel supporting these – represent a major component of overall cost structures for SAP systems.

In comparing Oracle 10g and DB2 9 costs, the most visible difference is in database license and support fees. Oracle 10g licenses are offered by SAP for 11 percent of SAV, while DB2 9 is offered for 8 percent of SAV. If Oracle Real Application Clusters (RAC) is employed, Oracle 10g license costs increase to 14 percent of SAV. The DB2 9 equivalent of RAC, High Availability and Disaster Recovery (HADR), is a no-charge offering.

Although support costs for both platforms are the same as a percentage of license fees (17 percent per year), lower initial DB2 9 license costs mean that in practice these fees are lower than for Oracle 10g.

User experiences indicate, however, that there are a number of DB2 9 capabilities that affect other variables of comparative costs. These include deep data compression, which can reduce disk and tape capacity requirements, and design features that allow organizations to achieve comparable or superior levels of performance with fewer processor resources.

The effects of these capabilities tend to overlap. Compression, for example, enables higher levels of capacity utilization and reduces memory and I/O costs not only for storage systems, but also for database servers. Although capacity gains are partially offset by additional processor overhead for running compression processes, the overall result is to magnify database server savings. Increased I/O throughput also enables faster query performance and reduces data load and replication times.

For database servers, compression effects build upon the performance advantages of lightweight DB2 database structures. Improvements in dialog, batch and query performance have been extensively reported by organizations that have migrated SAP systems from Oracle to earlier DB2 versions, indicating that differences in relative performance are due to more than higher levels of data compression.

Disparities in SAP NetWeaver Business Intelligence (SAP NetWeaver BI) query performance have been particularly striking, with users reporting improvements of up to eight to nine times in performance for processes involving repetitive queries, large tablespaces, or both. DB2 9 Database Partitioning Feature (DPF) and Multi-Dimensional Clustering (MDC) are also reported to yield significant performance benefits for high-end systems.

There is also evidence that DB2 9 enables higher levels of productivity for database administration and related functions than are typically realized with Oracle 10g, which results in lower full-time equivalent (FTE) staffing. Disparities in this area have been extensively observed and commented on for SAP as well as for non-SAP environments.

DB2 9 productivity levels are enhanced by a number of capabilities that have been specifically optimized for SAP environments by IBM and SAP. Auto-tuning capabilities draw upon high levels of SAP configuration and workload awareness, which means that tuning and configuration management tasks requiring manual intervention in Oracle 10g installations are often handled directly by DB2 9.

Overlaps are also apparent in this area. In addition to increasing administrator productivity, automated tuning can result in performance benefits and capacity savings because system resources are used more efficiently. Equally, higher levels of data compression translate into timesavings for such processes as copying, backup and recovery, and upgrades because overall database size is reduced.

The prevalence of overlaps and interdependencies between the effects of different DB2 9 capabilities argues for a broad approach to cost measurement that extends across all principal hardware and software components of database infrastructures as well as related personnel and other operational costs. This is the approach taken here.

Cost Components

The overall list of cost components potentially affected by differences in Oracle 10g and DB2 9 capabilities proves to be extensive. It includes the following:

- ***Storage systems***. Higher levels of compression mean that less physical disk and tape capacity is required. This translates into lower hardware acquisition and maintenance costs. 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 can also be expected in license and support fees for these.

Disk system savings may extend to specialized retention systems employing Serial Advanced Technology Attachment (SATA) and equivalent media as well as primary disk storage. For tape operations, additional savings can be expected in media and handling costs, including secure storage for retained cartridges.

- ***Database servers***. The ability to realize higher levels of performance with equivalent processor capacity and to employ more streamlined memory and I/O configurations translates into de facto savings in hardware acquisition and maintenance costs. In addition, where operating systems and other systems software products are priced based on numbers of processors or equivalent metrics, savings may also be realized in license and support costs for these.

  For storage systems as well as database servers, it can also be expected that use of smaller configurations will result in lower facilities costs. Savings in data center occupancy, power and cooling costs may be significant.

  This will particularly be the case if allowance is made for acquisition, maintenance, support and occupancy costs of uninterruptible power supplies (UPS), power distribution systems (PDS), cooling equipment, backup generators and other support equipment. Although equipment may not be dedicated to specific systems, a portion of overall data center costs for these may reasonably be allocated based on relative power consumption or equivalent metrics.

- ***Personnel costs***. Lower FTE staffing levels for database and storage administration tasks translate into lower personnel costs for database administrators (DBAs) as well as Basis administrators. Realistic calculations of comparative costs would include not only salaries, but also such items as bonuses, benefits and training. Some organizations also allow for occupancy, overhead and other costs per FTE.

  (Although the term "Basis administrator" is not, in principle, appropriate for ERP 6.0 solutions, it was widely employed by companies that contributed to this report. No comparable term for ERP 6.0 administrators appears to have achieved widespread acceptance. "Basis administrator" is thus used throughout this report.)

- ***Upgrade cost***s. It can be expected that distinctive DB2 9 capabilities, such as deep compression and "silent installation" (meaning the ability of DB2 9 system to auto-configure for ERP 6.0 software environments and workload parameters), would also reduce the amount of time required for SAP version upgrades. This could translate into significant savings in internal staff and outside services costs.

  Industry experience has shown that costs of downtime may be substantial even for comparatively short outages. This is particularly the case if manufacturing and supply chain operations are characterized by accelerated process cycles and low levels of inventory buffering. In highly competitive industries, interruption of customer and supplier communications may also result in significant lost opportunity costs.

This list should not be considered exhaustive.

Basis of Calculations

Overview

The cost comparisons presented in this report were developed using a three-phase approach. First, three composite profiles of ERP 6.0 installations in manufacturing companies were prepared.

Second, scenarios were developed for use of Oracle 10g and DB2 9 in each installation. Allowance was made for differences in database, storage and server configurations, and in staffing levels due to the DB2 9 capabilities described in the previous section. Third, initial and five-year operating costs were calculated for baseline as well as migration comparisons, and transition costs were added to DB2 9 scenarios for the latter. These phases are described below.

Profiles

Installation profiles are summarized in figure 7.

Figure 7
Installation Profiles Summary

	Industrial Machinery Manufacturer	High-Tech Manufacturer	Automotive Parts Manufacturer
Business Profile	$8 billion c. 30,000 employees Manufacturer of industrial machinery, tools & parts; maintenance services 80 manufacturing plants & 25 distribution centers	$5 billion c. 20,000 employees Manufacturer of electronic systems, components & subassemblies 18 manufacturing & distribution facilities	$3 billion c. 10,000 employees Tier 1 automotive parts manufacturer 25 manufacturing & distribution facilities
SAP Applications	SAP for Industrial Machinery & Components CO, FI, HCM, MM, PM, PS, SAM, SD, TR, WM APO, BI, CFM, CRM, PLM, SEM EP, xMII, XI	SAP for High Tech CO, FI, HCM, MM, PM, PP, QM, SD, SRM APO, BI, CRM, GTS, PLM EP, MDM, ESS, XI	SAP for Automotive CO, FI, HCM, MM, PLM, PM, PP, PS, QM, SCM, SD BI, CRM EP, ESS, ICH, xLPO
Number of Users	5,300+	3,200+	2,500+

A list of abbreviations for SAP applications may be found in figure 11.

Profiles were constructed using data on application portfolios, databases, user populations, workloads, server and storage bases, administration staffing levels and other variables supplied by 21 companies in the same industries and approximate size ranges, with generally similar business profiles.

Because few large companies have deployed entire suites of ERP 6.0 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 automotive parts manufacturer profile, for example, the experiences of one company with SAP ERP and Customer Relationship Management systems were combined with those of a second with NetWeaver BI, Product Lifecycle Management, and Supply Chain Management applications, and others with Inventory Collaboration Hub and xApp Lean Planning and Operations. All companies employed SAP for Automotive solutions.

Profiles for the industrial machinery and high-tech manufacturers were constructed in a similar manner.

All three installations are characterized by best practice implementation in system and data center consolidation, business continuity, backup and recovery, and database, server and storage administration. The industrial machinery manufacturer employs three regional data centers supporting SAP systems, while the high-tech and automotive parts manufacturers employ two each. Solutions for real-time replication and failover to alternate data centers are in place in all three companies.

In all cases, ERP 6.0 suites with Unicode capability formed the basis of calculations. Profiles and scenarios include development, test, quality assurance, and other non-production as well as production instances of databases, and of platforms supporting these.

Scenarios

Scenarios include database, disk system and tape system configurations, along with FTE staffing levels for database and storage administration tasks affected by capability differences between Oracle 10g and DB2 9. Oracle 10g scenarios for each installation represent baselines for calculations.

For DB2 9 scenarios, configurations and staffing levels were reduced using the following values:

- ***Data compression***. Calculations assume DB2 9 compression rates of 45 percent for NetWeaver BI databases, and 40 percent for other databases. These values, which represent compression levels relative to Oracle 10g, are applied to disk and tape system capacities, backup operations and tape media consumption. They also contribute to comparative performance values for database servers.
- ***Database server performance***. Calculations assume that database servers in DB2 9 scenarios deliver 30 percent and 20 percent higher performance for NetWeaver BI and other systems respectively compared to Oracle 10g. These values are net of processor overhead required for DB2 9 compression. Server configurations in DB2 9 scenarios are reduced accordingly.
- ***Database-related staffing***. Calculations assume a 25 percent lower FTE headcount in DB2 9 scenarios for database-related tasks performed by DBAs and Basis administrators compared to Oracle 10g scenarios.

These values should be regarded as conservative.

Configurations

Configurations were developed as follows:

- ***Databases***. Configurations were based on use of Oracle 10g or DB2 9 for all systems. Scenarios for both platforms include management and support tools made available by SAP without additional charge.
- ***Disk systems***. The companies upon which profiles 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 DS8100 Turbo systems based on installed capacity in terabytes (TB), and on required performance characteristics for specific applications or groups of applications. Systems were equipped with 300-gigabyte (GB) drives operating at 10,000 revolutions per minute (rpm).

For five-year calculations of operating costs, allowance was also made for capacity growth rates of from 5 to 18 percent per year, depending on applications, for the industrial machinery manufacturer; from 10 to 27 percent for the high-tech manufacturer; and from 5 to 20 percent for the automotive parts manufacturer. Configurations were upgraded accordingly.

Systems were configured and upgraded in increments of 4.8 TB, corresponding to 16 x 300 GB drives, and ranged from 9.6 TB to 38.4 TB. In translating other vendors' systems to DS8100 Turbo models, and in allowing for ongoing capacity growth, configurations were rounded to the next largest increment.

Systems were configured with IBM software products employed for business continuity (Global Mirror and Metro Mirror, for remote or local replication and failover respectively) and point-in-time-copy (FlashCopy), along with the TotalStorage Productivity Center (TPC) management suite. All of the companies upon which profiles were based employed these or functionally equivalent products from other vendors.

The use of IBM disk systems and software for cost comparisons tends to understate cost savings that would be experienced by users employing other vendors' offerings. This is particularly the case for operating costs.

As figure 8 shows, IBM warranties tend to be significantly longer than those of competitors. Over a five-year period, maintenance and (to an even greater extent) software support costs would be significantly higher for non-IBM platforms.

Figure 8
Vendor Warranty Durations for Disk System Products

VENDOR	PRODUCT TYPE	PRODUCT	DURATION
EMC	High-end disk system	DMX hardware & OS	Two years
	Midrange disk system	CLARiiON hardware & OS	Two years
	Enterprise software	Other DMX & CLARiiON software	90 days
Hewlett-Packard	Midrange disk system	EVA 4100/6100/8100 hardware & OS	Two years
	Enterprise software	Other EVA software	90 days
Hitachi Data Systems	High-end disk system	USP V & TagmaStore hardware & OS	Three years
	Enterprise software	Other software	90 days
IBM	High-end disk system	DS8000 & DS6800 hardware & OS	Four years
		Copying & replication software	Four years
	Midrange disk system	DS4000 Hardware & OS	Three years
		Copying & replication software	Three years
	Other software	TSM, TPC	One year

- ***Tape systems***. The companies upon which profiles were based employed a variety of tape storage systems. For the comparisons presented in this report, these were translated, based on capacity and throughput requirements, into current-generation IBM TS3500 Tape Library systems employing Linear Tape Open Ultrium Generation 4 (LTO-4) drives.

  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. Most of the companies upon which profiles were based employed these or similar practices.

Allowance was made for growth in backup volumes over five-year periods. These generally paralleled the capacity growth rates for disk storage systems cited above.

- ***Database servers***. The companies upon which profiles were based employed a variety of UNIX server platforms from Fujitsu Siemens, Hewlett-Packard, IBM and Sun Microsystems. To ensure comparability of results, these were translated into configurations of current-generation IBM POWER6-based System p 570 models based on vendor and industry comparative performance data for SAP applications.

  System p 570 configurations include 4- to 16-way models employing 3.5 GHz, 4.2 GHz or 4.7 GHz processors. Configurations employed in scenarios were calculated based on required performance levels for specific applications (e.g., NetWeaver BI) or groups of applications (e.g., ERP systems).

  (Although IBM offers a broad range of System p models, the System p 570 was at the time of writing the only model group to incorporate the company's latest POWER6 generation of processor technology.)

  Allowance was made for annual workload growth rates of from 5 to 20 percent per year for the industrial machinery manufacturer, depending on applications; from 10 to 25 percent for the high-tech manufacturer; and from 3 to 21 percent for the automotive parts manufacturer. Configurations were upgraded over a five-year period to accommodate growth.

  In translating other vendors' systems to System p 570 models, and in allowing for ongoing capacity growth, configurations for this platform were rounded to the next largest capacity increment offered by IBM.

  For the industrial machinery and high-tech manufacturer profiles, growth rates for certain applications or groups of applications required configurations larger than those supported by IBM for the System p 570 before the end of the five-year calculation period (the current maximum for this platform is 16 processors).

  Where this was the case, larger 20- to 28-way models were projected based on current System p 570 performance levels and estimated levels of symmetric multiprocessing (SMP) overhead for configurations in this size range. It can be expected that IBM will introduce POWER6-based server models in this range within the next few years.

  Database server models were equipped with the IBM AIX operating system and, for clustered failover configurations, High Availability Cluster Multiprocessing (HACMP) software. The IBM Tivoli Storage Manager (TSM) backup package is also employed on at least one server in each scenario.

  It was assumed that profile companies employed best practice levels of server consolidation employing System p Logical Partition (LPAR), Workload Partition (WPAR) and virtualization technologies. Individual server models thus in many cases support multiple database instances.

  With the exception of TSM servers, scenarios do not include application, Web and other types of server employed in SAP environments.

Configurations and staffing levels for database-related personnel for Oracle 10g and DB2 9 scenarios are summarized in figures 9 and 10 respectively. These are the same for baseline and migration comparisons.

Figure 9

Configurations and Staffing Summary: Oracle 10g Scenarios

Industrial Machinery Manufacturer	High-Tech Manufacturer	Automotive Parts Manufacturer
DISK SYSTEMS		
Initial Configuration		
1 x DS8100 x 24.0 TB 1 x DS8100 x 14.4 TB *Global Mirror, FlashCopy, TPC* 2 x DS8100 x 9.6 TB *FlashCopy, TPC*	2 x DS8100 x 19.2 TB *Metro Mirror, FlashCopy, TPC* 3 x DS8100 x 14.4 TB *FlashCopy, TPC*	1 x DS8100 x 14.4 TB 1 x DS8100 x 9.6 TB *Global Mirror, FlashCopy, TPC* 1 x DS8100 x 14.4 TB *FlashCopy, TPC*
End of Period Configuration		
1 x DS8100 x 38.4 TB 1 x DS8100 x 24.0 TB *Global Mirror, FlashCopy, TPC* 1 x DS8100 x 19.2 TB 1 x DS8100 x 14.4 TB *FlashCopy, TPC*	2 x DS8100 x 38.4 TB *Metro Mirror, FlashCopy, TPC* 1 x DS8100 x 33.6 TB 2 x DS8100 x 28.8 TB *FlashCopy, TPC*	1 x DS8100 x 24.0 TB 1 x DS8100 x 19.2 TB *Global Mirror, FlashCopy, TPC* 1 x DS8100 x 28.8 TB *FlashCopy, TPC*
TAPE SYSTEMS		
Initial Configuration		
TS3500 6 x LTO-4	TS3500 8 x LTO-4	TS3500 4 x LTO-4
End of Period Configuration		
TS3500 10 x LTO-4	TS3500 18 x LTO-4	TS3500 7 x LTO-4
DATABASE SERVERS		
Initial Configuration		
16 x 4.2 GHz, 12 x 4.2 GHz 2 x (4 x 4.2 GHz) 4 x (4 x 3.5 GHz) *AIX, HACMP, TSM*	2 x (16 x 4.7 GHz) 8 x 4.2 GHz, 8 x 3.5 GHz 2 x (4 x 4.2 GHz) 4 x 3.5 GHz *AIX, HACMP, TSM*	8 x 4.2 GHz, 8 x 3.5 GHz 2 x (4 x 4.7 GHz) 4 x 4.2 GHz 2 x (4 x 3.5 GHz) *AIX, HACMP, TSM*
End of Period Configuration		
20 x 4.7 GHz, 16 x 4.7 GHz 2 x (8 x 4.7 GHz), 8 x 4.2 GHz 4 x 4.7 GHz, 4 x 4.2 GHz 4 x 3.5 GHz *AIX, HACMP, TSM*	28 x 4.7 GHz, 24 x 4.7 GHz 16 x 4.7 GHz, 12 x 4.7 GHz 3 x (8 x 4.7 GHz) *AIX, HACMP, TSM*	2 x (12 x 4.7 GHz) 8 x 4.7 GHz, 8 x 4.2 GHz 3 x (4 x 4.7 GHz) *AIX, HACMP, TSM*
PERSONNEL		
Initial Staffing		
4.25 FTEs	5.15 FTEs	3.6 FTEs
End of Period Staffing		
4.85 FTEs	6.25 FTEs	4.05 FTEs

Figure 10

Configurations Summary: DB2 9 Scenarios

Industrial Machinery Manufacturer	High-Tech Manufacturer	Automotive Parts Manufacturer
DISK SYSTEMS		
Initial Configuration		
1 x DS8100 x 14.4 TB 1 x DS8100 x 9.6 TB *Global Mirror, FlashCopy, TPC* 1 x DS8100 x 9.6 TB *FlashCopy, TPC*	2 x DS8100 x 9.6 TB *Metro Mirror, FlashCopy, TPC* 1 x DS8100 x 14.4 TB 1 x DS8100 x 9.6 TB *FlashCopy, TPC*	1 x DS8100 x 9.6 TB 1 x DS8100 x 4.8 TB *Global Mirror, FlashCopy, TPC* 1 x DS8100 x 9.6 TB *FlashCopy, TPC*
End of Period Configuration		
1 x DS8100 x 24.0 TB 1 x DS8100 x 14.4 TB *Global Mirror, FlashCopy, TPC* 1 x DS8100 x 19.2 TB *FlashCopy, TPC*	1 x DS8100 x 28.8 TB 1 x DS8100 x 24.0 TB *Metro Mirror, FlashCopy, TPC* 1 x DS8100 x 33.6 TB 1 x DS8100 x 14.4 TB *FlashCopy, TPC*	2 x DS8100 x 14.4 TB *Global Mirror, FlashCopy, TPC* 1 x DS8100 x 14.4 TB *FlashCopy, TPC*
TAPE SYSTEMS		
Initial Configuration		
TS3500 4 x LTO-4	TS3500 6 x LTO-4	TS3500 3 x LTO-4
End of Period Configuration		
TS3500 6 x LTO-4	TS3500 12 x LTO-4	TS3500 4 x LTO-4
DATABASE SERVERS		
Initial Configuration		
12 x 3.5 GHz, 8 x 4.2 GHz 6 x (4 x 3.5 GHz) *AIX, HACMP, TSM*	2 x (12 x 4.2 GHz), 4 x 4.7 GHz 2 x (4 x 4.2 GHz) 2 x (4 x 3.5 GHz) *AIX, HACMP, TSM*	2 x (8 x 3.5 GHz) 5 x (4 x 3.5 GHz) *AIX, HACMP, TSM*
End of Period Configuration		
16 x 4.7 GHz, 12 x 4.7 GHz 8 x 4.7 GHz 2 x (8 x 4.2 GHz) 3 x (4 x 3.5 GHz) *AIX, HACMP, TSM*	24 x 4.7 GHz, 20 x 4.7 GHz 12 x 4.7 GHz 2 x (8 x 4.7 GHz) 8 x 4.2 GHz, 4 x 3.5 GHz *AIX, HACMP, TSM*	2 x (8 x 4.2 GHz) 8 x 4.7 GHz, 8 x 3.5 GHz 2 x (4 x 4.7 GHz) 4 x 3.5 GHz *AIX, HACMP, TSM*
PERSONNEL		
Initial Staffing		
3.2 FTEs	3.85 FTEs	2.7 FTEs
End of Period Staffing		
3.65 FTEs	4.7 FTEs	3.05 FTEs

Cost Values

The following cost values were employed:

- ***Database costs***. For Oracle 10g and DB2 9 scenarios, calculations were based on initial license costs of 11 percent and 8 percent respectively of SAV totals for each profile. Support costs for both sets of scenarios were calculated as 17 percent of initial license costs per year for five years. For migration cost comparisons, support costs only were included in calculations.
- ***Storage system and database server costs***. Initial costs for all platforms include beginning-of-period hardware and software acquisition. Operating costs include acquisition costs for hardware and software upgrades to support capacity growth; five-year hardware maintenance and software support costs, net of applicable warranties; and facilities costs, which are described below. Hardware maintenance and software support costs are for 24x7 coverage.

  (In IBM nomenclature, ongoing software support is referred to as "Software Maintenance." However, because SAP prefers the term "software support," this is employed throughout this report. Costs are the same.)

  Costs for acquisition of disk storage system and database server hardware to support ongoing growth are assumed to decline at annual rates of 30 and 25 percent respectively. Operating costs for tape systems also include costs for acquisition, handling and secure storage of cartridges. All costs were calculated using discounted street prices.
- ***Personnel costs***. These were calculated using first-year salaries of U.S. $93,375 and $91,198 per year for Oracle 10g and DB2 9 database administrators respectively, and $80,914 and $77,263 per year for Basis administrators respectively. All salaries are increased by 4 percent per year starting in the second year, and lifted by 24.7 percent to allow for bonuses, benefits, training and related items.
- ***Facilities costs***. These were calculated for disk and tape systems, and database servers using IBM specifications. Calculations include costs for data center occupancy, power and cooling as well as allowance for acquisition, maintenance and operational costs for support equipment, including UPS, PDS, chillers and backup generator capacity. Support equipment costs 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 profiles 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 assumptions employed were for U.S. costs.

- ***Transition costs***. For DB2 9 scenarios for migration cost comparisons, transition costs include data conversion and staff retraining. Data conversion costs were calculated based on database sizes and functional characteristics, including non-production as well as production instances, for each major application or group of applications. It was assumed that conversion was performed by IBM specialists at a cost to the customer of $1,500 per person per day.

  Staff retraining costs were calculated assuming eight days of SAP training per administrator. Calculations include costs of classes, administrator time, and travel and lodging expenses.

All cost values were current at the time of writing.

Detailed Tables

SAP application abbreviations employed in this report are shown in figure 11. Detailed cost breakdowns are presented in figures 12 and 13.

Figure 11
SAP Software Abbreviations

APPLICATIONS		APPLICATIONS	
APO	Advanced Planner & Optimizer	**PM**	Plant Maintenance
BI	NetWeaver Business Intelligence	**PP**	Production Planning
CO	Controlling	**PS**	Project System
CFM	Corporate Finance Management	**QM**	Quality Management
CRM	Customer Relationship Management	**SAM**	Service & Asset Management
EP	Enterprise Portal	**SCM**	Supply Chain Management
ESS	Employee Self Service	**SD**	Sales & Distribution
FI	Financial Accounting	**SEM**	Strategic Enterprise Management
GTS	GRC Global Trade Services	**SRM**	Supplier Relationship Management
HCM	ERP Human Capital Management	**TR**	Treasury & Cash Management
ICH	Inventory Collaboration Hub	**WM**	Warehouse Management
MDM	NetWeaver Master Data Management	**xLPO**	xApp Lean Planning & Operations
MM	Materials Management	**xMII**	xApp Manufacturing Integration & Intelligence
PLM	Product Lifecycle Management	**XI**	NetWeaver Exchange Infrastructure

Figure 12

Detailed Five-year Cost Breakdowns: Oracle 10g Scenarios

	Industrial Machinery Manufacturer	High-Tech Manufacturer	Automotive Parts Manufacturer
DATABASES (BASELINE COMPARISONS)			
Total ($000)	**3,196.8**	**2,729.7**	**2,072.6**
DATABASES (MIGRATION COMPARISONS)			
Total ($000)	**1,468.8**	**1,254.2**	**952.3**
DISK SYSTEMS			
Hardware (Initial)	1,325.3	1,778.9	951.1
Hardware (Operating)	169.7	295.8	140.9
Hardware maintenance	207.1	278.0	148.6
Software licenses (Initial)	944.0	1,163.2	676.1
Software licenses (Operating)	426.8	834.8	304.4
Software support	473.1	656.0	334.3
Facilities (Initial)	8.5	11.6	5.8
Facilities (Operating)	50.1	69.8	40.4
Total ($000)	**3,604.6**	**5,088.1**	**2,601.6**
TAPE SYSTEMS			
Hardware (Initial)	118.3	143.3	93.4
Hardware (Operating)	50.0	145.9	37.5
Hardware maintenance	5.9	5.9	5.9
Media	296.2	473.9	207.3
Facilities (Initial)	0.9	1.1	0.6
Facilities (Operating)	10.9	14.1	9.1
Total ($000)	**482.2**	**784.2**	**353.8**
DATABASE SERVERS			
Hardware (Initial)	1,087.2	1,474.3	776.4
Hardware (Operating)	225.0	485.7	155.4
Hardware maintenance	390.7	478.1	272.5
Software licenses (Initial)	154.8	179.2	99.5
Software licenses (Operating)	49.1	123.6	61.7
Software support	355.0	445.1	218.2
Facilities (Initial)	2.9	3.3	2.0
Facilities (Operating)	11.9	14.8	8.8
Total ($000)	**2,276.6**	**3,204.1**	**1,594.5**
PERSONNEL			
Total ($000)	**2,570.7**	**3,203.2**	**2,139.9**
TOTAL FIVE-YEAR COSTS (BASELINE COMPARISONS)			
Initial	5,370.0	6,230.5	3,725.1
Operating	6,760.9	8,778.8	5,037.2
TOTAL ($000)	**12,130.9**	**15,009.3**	**8,762.3**
TOTAL FIVE-YEAR COSTS (MIGRATION COMPARISONS)			
Initial	3,642.0	4,755.0	2,604.8
Operating	6,760.9	8,778.8	5,037.2
TOTAL ($000)	**10,402.9**	**13,533.8**	**7,642.0**

Figure 13

Detailed Five-year Cost Breakdowns: DB2 9 Scenarios

	Industrial Machinery Manufacturer	High-Tech Manufacturer	Automotive Parts Manufacturer
DATABASES (BASELINE COMPARISONS)			
Total ($000)	**2,324.9**	**1,985.2**	**1,507.4**
DATABASES (MIGRATION COMPARISONS)			
Total ($000)	**1,674.93**	**1,502.96**	**1,124.69**
DISK SYSTEMS			
Hardware (Initial)	895.9	1,176.2	783.9
Hardware (Operating)	45.6	236.4	75.6
Hardware maintenance	140.0	183.8	122.5
Software licenses (Initial)	632.4	714.0	461.2
Software licenses (Operating)	210.9	612.5	293.0
Software support	282.8	399.0	206.2
Facilities (Initial)	5.5	7.3	4.3
Facilities (Operating)	32.5	52.2	23.4
Total ($000)	**2,245.6**	**3,381.4**	**1,970.1**
TAPE SYSTEMS			
Hardware (Initial)	93.4	118.3	80.9
Hardware (Operating)	25.0	75.0	12.5
Hardware maintenance	5.9	5.9	5.9
Media	185.1	288.8	125.9
Facilities (Initial)	0.6	0.7	0.4
Facilities (Operating)	8.6	10.8	7.4
Total ($000)	**318.6**	**499.5**	**233.0**
DATABASE SERVERS			
Hardware (Initial)	783.3	971.4	625.6
Hardware (Operating)	253.4	417.2	64.8
Hardware maintenance	328.4	377.2	223.6
Software licenses (Initial)	123.6	131.1	99.5
Software licenses (Operating)	46.2	107.9	16.7
Software support	313.8	347.1	214.5
Facilities (Initial)	2.4	2.4	2.0
Facilities (Operating)	10.0	13.8	8.4
Total ($000)	**1,861.1**	**2,368.1**	**1,255.1**
PERSONNEL			
Total ($000)	**1,854.5**	**2,309.1**	**1,545.2**
TOTAL FIVE-YEAR COSTS (BASELINE COMPARISONS)			
Initial	3,793.8	4,194.5	2,872.6
Operating	4,810.9	6,348.8	3,638.2
TOTAL ($000)	**8,604.7**	**10,543.3**	**6,510.8**
TOTAL FIVE-YEAR COSTS (MIGRATION COMPARISONS)			
Initial	3,357.5	3,894.8	2,628.4
Operating	4,597.3	6,166.4	3,499.7
TOTAL ($000)	**7,954.8**	**10,061.0**	**6,128.1**

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