IBM DB2 Universal Database V8.1 vs. Oracle9iR2: Total Cost of Ownership
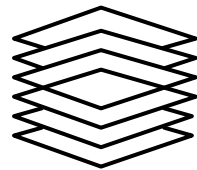
November 2002

A D.H. Brown Associates, Inc. White Paper Prepared for

IBM

TABLE OF CONTENTS

IBM DB2 Universal Database V8.1 vs. Oracle9iR2: Total Cost of Ownership

Part I: Introduction

CHAPTER 1: EXECUTIVE SUMMARY

During this period of economic slowdown, companies are especially careful to ensure that their IT investments enable a maximum return on investment (ROI). To help customers understand their enterprise database management system (DBMS) choices, this study evaluates the two leading DBMS platforms – IBM's DB2 Universal Database and Oracle Corporation's Oracle9iR2 – in terms of four expense categories: software, service, development, and maintenance. This study concludes that, while the two products provide functionally equivalent technologies, they vary significantly in total cost of ownership (TCO).[1] Although the weights of these expense categories may vary by customer environments and applications, DB2's advantages suggest that it is the more economical choice over a five-year period for almost all scenarios.

The major conclusions derived from this study are,

- **Software Pricing:** DB2 Universal Database (DB2 UDB) V8.1 holds a strong price advantage for all situations where the DBMS will be accessed from an external Internet. DB2 UDB V8.1 holds a similarly strong advantage for all configurations that support 27 or more named users per CPU, and it lists at 54% of Oracle's price on systems configured with 50 named users or more per CPU. The greatest price advantage for DB2 is in high-availability configurations with failover capability. In these situations, Oracle can cost three to four times as much as DB2 or higher.

- **Service Pricing:** The DB2 UDB V8.1 pricing advantage is magnified when Passport Advantage service and discounts are applied. After discounts are applied, five-year 24x7 support with an upgrade subscription costs 74% – 88% of DB2's license list price and 86% – 104% of Oracle's license list price. Most important, DB2 net pricing is reduced from 54% of Oracle pricing to 49% – 53 % of Oracle pricing.

- **Packaging:** DB2 UDB V8.1 adds value even further by bundling starter products for business intelligence, mainframe connectivity, and application development into the base product. These options can provide valuable efficiency and experience for low-volume tasks, where purchase of the tool would otherwise not be considered. They also provide easy procurement and

---

[1] In this report, the term TCO is used loosely to encompass costs for software, services, development, and maintenance. Obviously, other costs could be factored in, most notably, hardware-related costs.

a no-strings-attached evaluation copy when the tool is being considered for purchase. This enables users and developers to try out these products within their own timeframes, not the arbitrary time limitations that are attached to most evaluation copies. Furthermore, users can continue to keep their trial applications active even if they do not purchase the product.

- **Database Administration (DBA) Efficiencies:** DBA efficiencies complement the DB2 UDB V8.1 pricing advantages. Both DB2 UDB V8.1 and Oracle9iR2 are mature products that automate many DBA tasks. Even so, DB2 UDB V8.1 exceeds Oracle9iR2 in its installation routine, query optimization, architecture for distributed database, and query governance. It also exceeds Oracle efficiencies in tuning, monitoring, and troubleshooting. Oracle9iR2 only partially offsets these efficiencies with its data movement and change-management facilities. The DB2 UDB V8.1 advantage reflects a greater level of automation that shields the DBA from much technical complexity, enabling less experienced personnel to perform many tasks and empowering end users to self-manage their queries to a greater degree than with Oracle9iR2. On average, DB2 UDB V8.1 efficiencies yield an overall reduction in the work effort of 15% for OLTP and large OLTP systems, 15% for Internet-enabled databases, and 15% for data warehousing.

- **Five-Year TCO:** Four scenarios combine the costs of software, services, and staffing to create a TCO for OLTP, large OLTP, Internet, and data warehousing applications. DB2 UDB V8.1 provides TCO advantages in all four scenarios, saving the customer 27% – 34% compared with Oracle9iR2 in the first three scenario, and saving the customer 14% in the data warehousing scenario.

CHAPTER 2: METHODOLOGY

This chapter reviews the various techniques used to gather information and perform the analyses contained in this study.

PRICE ANALYSES

SOURCE OF INFORMATION

Oracle9*i*R2 information is based upon its Software Investment Guide and Database Licensing pricelist of September 2002. DB2 UDB V8.1 information is based upon Passport Advantage pricing methodology provided by DB2 managers.

This analysis is based upon Oracle9*i*R2, which is in general availability status and upon IBM DB2 UDB V8.1, which has an announced availability date of November 21, 2002.

METHODOLOGY

When two vendors apply different pricing models to their products, the real value to customers may not be apparent at first glance. For this reason, we analyze the pricing rules to determine actual charges to customers across a range of installation sizes and using various pricing options.

PURPOSE

Several purposes underlie this study. First, it is designed to compare the TCO of DB2 UDB V8.1 vs. Oracle9*i*R2 under various product combinations and user environments. Second, it is designed to aid the customer with product selection by providing advance notice about pricing policies and relative values. In addition, customers may want to use this approach when making their own calculations, by modifying this model to suit their own special requirements.

EFFICIENCY ANALYSIS:
DATABASE DEVELOPMENT, ADMINISTRATION, AND OPERATION

Any large-scale initiative, such as database development or database maintenance, involves a combination of human-oriented and machine-oriented operations. Products vary both by the efficiency of their operations and by the amount of human-oriented activities required, such as planning, to complete a project. Part III of this study looks at each of these factors.

EFFICIENCY

Developing a methodology that compares the efficiency of two products is a challenge. Some machines run faster than others. Some workers perform faster than others. Unforeseen events may interrupt an operation. For these reasons, a

stopwatch style of evaluation is not useful. In response to this challenge, this study provides an approach to objectively evaluate the procedural efficiency that bypasses these obstacles. The technique counts logical operations, or the steps that a human must perform to accomplish the task at hand. Each keystroke or entry of data into a field counts as a single logical operation. Complex tasks, such as performing a look-up operation, are broken down into individual operations and counted separately. Offline activities, such as looking up information in a manual, calculating, or consulting with a supervisor, are similarly taken into account.

HUMAN ACTIVITIES

Efficiencies address only some of the tasks for database development and maintenance. Especially in mature technologies with a high degree of automation, repetitive tasks can be streamlined. With these operations out of the way, human-oriented tasks such as planning and scheduling come to occupy a considerable portion of the remaining effort for development and administration. These tasks, for the most part, lie beyond the scope of database efficiencies. When calculating a budget for a DBMS project, these human-oriented elements can eclipse the differences between the automated efficiencies of individual products.

The staffing required for performing the various activities in database design and administration can vary greatly from project to project. For this reason, determining the weights for these various activities was not a trivial task. To determine reasonable time allocations for various human-oriented activities, D.H. Brown Associates, Inc. (DHBA) interviewed dozens of DBAs and consultants who are actual practitioners in the field. The result is a set of plausible figures for estimating time allocations. The results in this study represent a composite of the testimonials provided by these practitioners. The introduction to Part III of this report summarizes these results and provides plausible time allocations for several different application environments. This is the most variable element in the report, with the greatest variation from project to project and from installation to installation. To apply the methodology to a particular organization, readers may wish to substitute their own figures based on their experience, their personnel, and their project requirements.

SCENARIOS

The scenarios that appear in Part IV of this study are representative of situations where DB2 offers substantial cost benefit over Oracle9iR2. These scenarios, including the details of the application and the configurations deployed, are based on real-life projects as narrated by practitioners in the field. To calculate the costs for each scenario, we used the pricing for software and service as described in the early chapters of the report. To calculate the efficiencies of each DBMS, we applied the efficiencies concepts, which are defined in this report. To estimate technical staff costs, we used the following numbers:

- Programmers and modelers @ $78,000 per year = $1,500 per week.
- DBAs @ $78,000 per year = $1,500 per week.

- DBAs and developers @ $104,000 per year = $2,000 per week.
- Consultants @ $1,500 per day.
- Senior Consultants @ $2,000 per day.

Once again, customers are invited to substitute figures that accommodate regional and time differences. These costs could be different, as illustrated by the following representative European costs:

- Programmers and modelers @ $60,000 per year = $1,150 per week.
- DBAs @ $60,000 per year = $1,150 per week.
- DBAs and developers @ $80,000 per year = $1,550 per week
- Consultants @ $1,500 per day.
- Senior Consultants @ $2,000 per day.

ALTERNATIVE METHODOLOGIES

EXAMPLE 1

One cost of ownership study attempted to collect pricing information through user interviews. Users can be a good source for pricing only if they disclose full information about the purchase. A proper analysis of pricing, no matter what the source of the information, must take into account the following information about the purchase:

- the number of named user and/or processor licenses;
- the platform on which the software is to run (if relevant to pricing);
- the version and release number of the software;
- the options that were purchased;
- the level of service purchased;
- the published price; and
- the cost of operation during the ownership period.

A good cost analysis must take into account and reconcile all of these factors. Studies have been published that simply evaluated the purchase price, without taking into account the size of the installation, the number of user and/or processor licenses, the options, or the service level purchased. Clearly such studies or analyses are incomplete or misleading.

EXAMPLE 2

Sometimes, TCO studies appear to be very credible and meticulously rendered, yet contain mistakes in methodology that invalidate the conclusions. Proper weighting of tasks is a sensitive area for error. Consider the following table, taken from a recently published study, that summarizes the number of steps required for ongoing DBA tasks.

Task	Number of Steps
Creating Users	1
Creating a Schema, Table, and Index	3
Loading Data	4
Reorganizing a Fragmented Table	3
Generating Statistics for Optimizer	4
Performing Schema Changes	4
Total Number of Steps	**19**

This total is used as the measure of overall efficiency for this category of tasks and becomes the basis for comparison with other products. However, the calculation is not complete; the number of steps must be multiplied by the *frequency* with which each task occurs. For example, a company may add ten users per month or 120 users per year but perform a reorg only one time per month or 12 times per year. Adjusting this weight, the Creating Users task takes on a weight of 120 whereas the Reorganizing a Fragmented Table task weighs only 36. Because the methodology is incomplete, the conclusions of the study cannot be valid. Methodology errors are often difficult to detect by the casual reader, yet they invalidate the conclusions.

A NOTE ON SURVEYS AND STATISTICS

Surveys and statistics can be valuable tools for research when they are properly executed and the results are carefully interpreted. Statisticians have devised rules for validity. When these rules are applied even loosely, we can gain a great deal of useful knowledge. When these rules are ignored, however, the results can be misleading and even false.

A truly scientific survey involves a large sample of participants. When the responses are fairly homogeneous, and most people agree, a relatively small sample can deliver valid results. When the responses vary greatly from one to another, a large sample is required in order to deliver valid results.

This study uses a variety of sources for its information: price lists, pricing policies as documented by each vendor, product documentation, interviews with users, consultants, vendors, marketers, and sales representatives. Marketing information was verified either in the documentation or through users before it was accepted as valid. User-derived information is presented as fact only when a consensus existed among all participants; otherwise it may appear as examples only.

A NOTE ON DISCLOSURE

Please note that this study details the steps and sources used in conducting the research. Therefore, the results are largely replicable and customizable. It is hoped that this open recounting of the processes underlying the study will be useful to the reader and will become a norm for future TCO studies.

Part II: Pricing and Packaging

CHAPTER 3: PRODUCT PRICING

DB2 UDB V8.1 Enterprise Server Edition (ESE) license fees are 54% of Oracle9*i*R2 license fees when used for external Internet deployment. In addition, DB2 UDB V8.1 ESE offers a substantial price benefit for all configurations with 27 or more named users, and it lists at 54% of Oracle9*i*R2 for all configurations with more than 50 users per processor. In configurations with 27 – 50 users per processor, DB2 UDB V8.1 ESE offers a significant price advantage, while in configurations with fewer than 27 users per processor, DB2 UDB V8.1 ESE lists slightly higher than Oracle9*i*R2. Similar results apply to data warehousing configurations.

PRICING MODELS

When two vendors use the same pricing model for their products, a value comparison is relatively easy. When vendors apply different pricing models and policies for their products, the real value to customers may not be apparent at first glance.

Pricing models for Oracle9*i*R2 and DB2 UDB V8.1 differ somewhat. DB2 UDB V8.1 uses a straightforward per-processor model, providing an unlimited user license for DB2 UDB V8.1 ESE and its options. Oracle9*i*R2's pricing strategy encompasses two models – an unlimited user model and a named-user model.

As a result of this discrepancy between pricing models, DB2 may be more economical in some cases whereas Oracle9*i*R2 might be more economical in other cases. For this reason, this study analyzes the pricing rules and price points to determine the actual charges to customers across a range of installation sizes and using the various pricing options. Resulting price schedules appear in the Appendix and are summarized in Exhibit 1.

EXHIBIT 1:
List Prices – DB2
UDB V8.1 ESE vs.
Oracle9iR2 EE
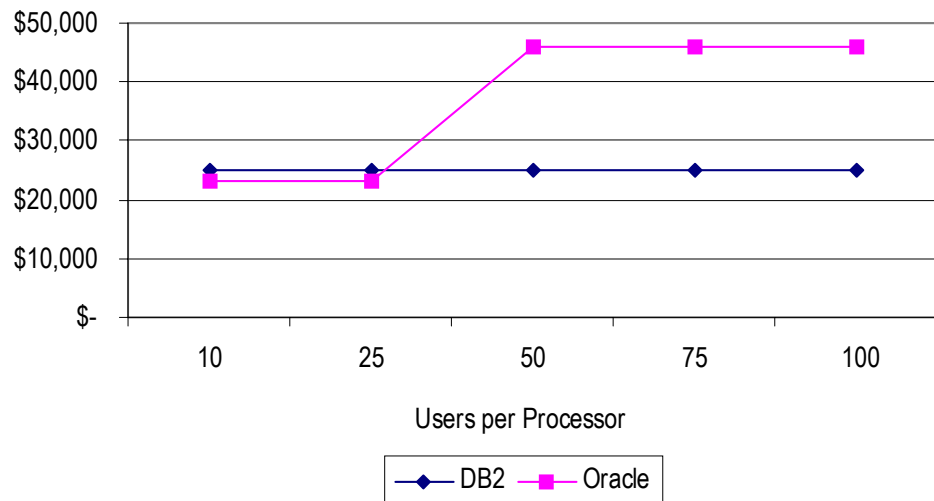
OLTP

For OLTP environments, we compare DB2 UDB V8.1 ESE[2] with Oracle9*i*R2 Enterprise Edition[3] (EE). A comparison of results reveals the following characteristics for each DBMS within an OLTP or Internet environment:

- Oracle9*i*R2 charges 184% of DB2 UDB V8.1 for unlimited-user licenses,[4] including configurations of 50 or more named users[5] per CPU.

- DB2 offers a price advantage for all installations that configure more than 27 named users per CPU.

- Under its named user policy, Oracle9*i*R2 charges 8% less than DB2 for configurations with up to 27 users per CPU.

Although the named-user option provides a slight cost advantage for certain CPU-intensive applications where a small number of users require much CPU power, it appears likely that many customers will opt for the per-processor pricing model in most cases for the following reasons:

- Management of named user licenses can be frustrating and time-consuming. Under the named user option, customers must notify Oracle9*i*R2 as users are added to the system. It is likely that any given system will grow over time, so that even systems purchased on a per-user basis will revert to per-processor pricing over time.

- Internet applications must operate under a per-processor license, since users cannot be named in advance. Intranet applications with a finite number of known users, however, can run under Oracle9*i*R2's named-user pricing, since the users can be identified.

- Under the named user pricing option, Oracle9*i*R2 does not distinguish between full-time users and occasionally connected users; customers must count all users, even those who log on just once or twice a week. For this reason, it is likely that many Oracle9*i*R2 customers will prefer the per-processor, unlimited-user pricing.

- The 8% savings for OLTP applications with fewer than 25 users per processor will likely reduce to approximately 1% after discounts are applied – DB2 applies discounts on purchases of $2,000 and up, while Oracle begins discounting at $25,000 purchases.

---

[2] The DB2 UDB V8.1 prices that appear in this chapter and in the Appendix are "reference" prices. These prices serve as the basis for calculating discounts and service.

[3] For the purposes of this paper, Oracle9*i*R2 EE pricing included the extra-cost Diagnosis and Tuning Packs that are add-ons to the Enterprise Manager.

[4] Oracle9*i*R2 per-processor licenses cost the equivalent of 50 named users and support an unlimited number of users.

[5] Officially called "Named User Plus" licenses. Oracle uses this terminology to make it clear that non-human devices, such as sensors, are counted as named users.

DATA WAREHOUSING

EXHIBIT 2:
List Prices – DB2 UDB
V8.1 ESE vs.
Oracle9iR2 Data
Warehouse Clusters
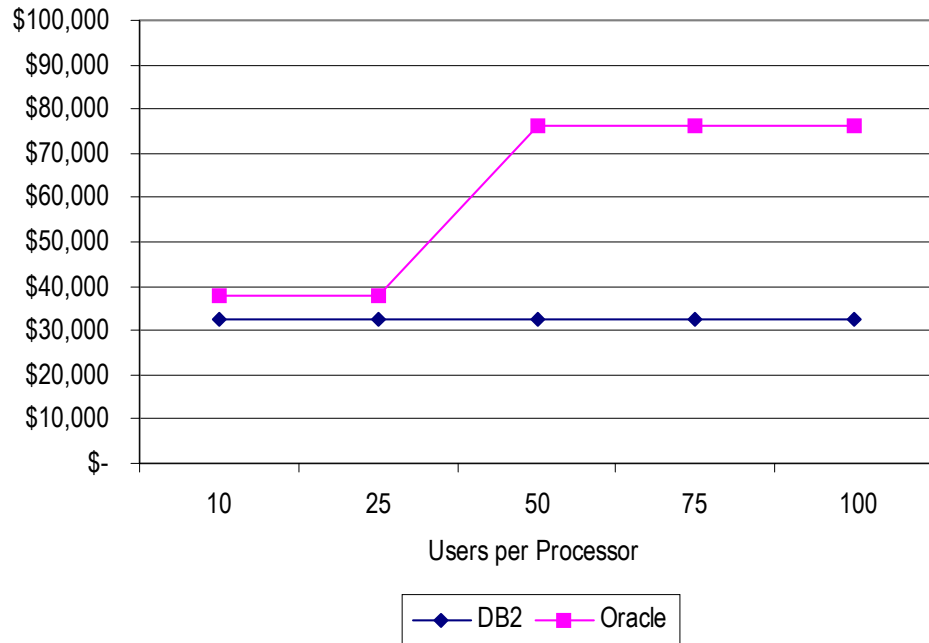
Clustered servers represent the high end of data warehousing environments. IBM customers require DB2 UDB V8.1 ESE with Database Partitioning Feature while Oracle customers require Oracle9iR2 with Partitioning Option and Real Application Clusters (RAC). In this environment, DB2 UDB V8.1 costs less than Oracle9iR2 in every configuration. DB2 costs 14.5% less than Oracle9i when configuring the minimum 25 users per CPU, and it costs 57% less when purchasing per-processor licenses.

EXHIBIT 3:
List Prices – DB2
vs. Oracle9iR2 SMP
Data Warehouse
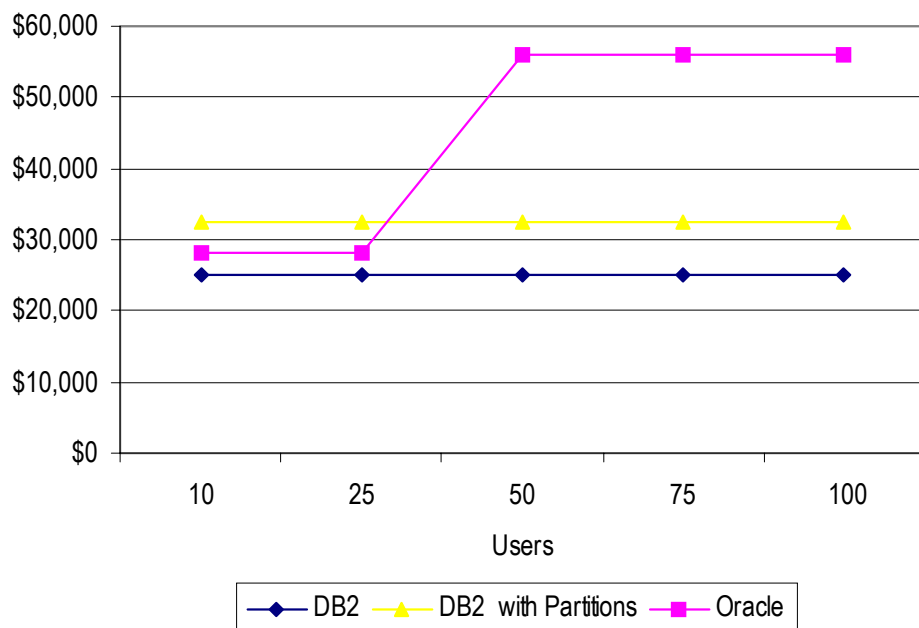
Most data warehouses and data marts are deployed on small SMP (symmetric multiprocessing) servers that hold fewer than ten CPUs. For these environments, DB2 requires only the base product, that is, DB2 UDB V8.1 ESE. For these environments, Oracle9iR2 requires Enterprise Edition plus the Partitioning option.[6] In this environment, DB2 UDB V8.1 provides a 12% advantage at 25 users per CPU and a 125% advantage when applying per-processor pricing.

Note, however, that this advantage shrinks in larger configurations that use DB2 UDB V8.1 Database Partitioning Feature in order to exploit the hardware partitioning on such platforms as the Sun E15000, HP Superdome, or pSeries 690. In these environments, Oracle9iR2 provides a 14% price advantage when configuring the minimum number of users per CPU. Using per-processor licensing, DB2 leads with pricing that is 48% of Oracle9iR2's.

SCALABILITY CLUSTERS WITH FAILOVER

EXHIBIT 4:
List Prices – DB2 vs.
Oracle9iR2 Scalability
Clusters with Failover
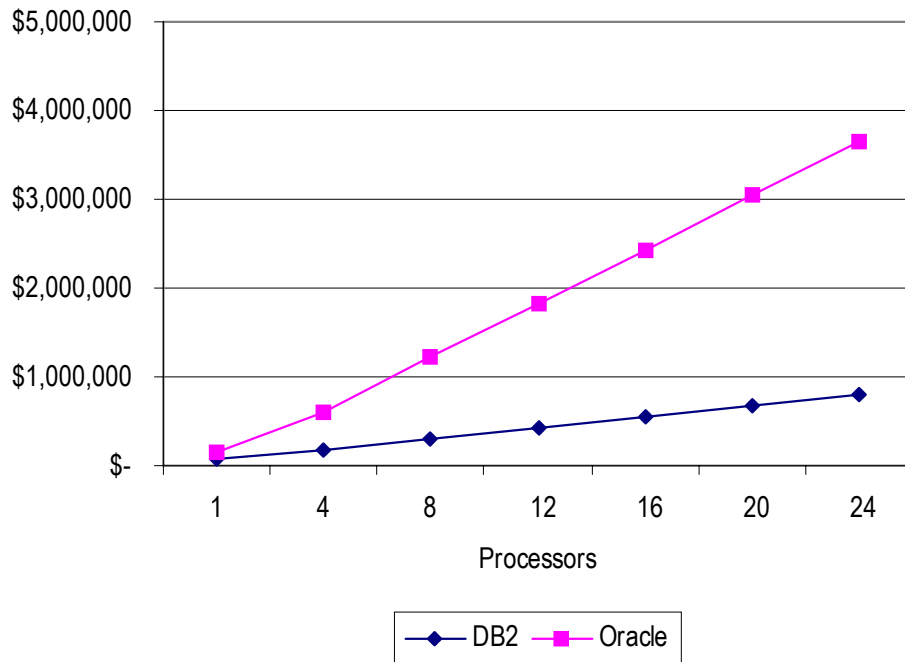
DB2 provides extremely advantageous pricing for configurations that include idle standby servers. This advantage results from two DB2 beneficial pricing rules. First, DB2 UDB V8.1 does not charge extra for clustering. A clustered environment can support both OLTP and data warehousing applications using DB2 UDB V8.1 ESE with Partitioning Feature; no additional DBMS software is

---

[6]   Oracle partitioning should not be confused with DB2 SMP partitioning. Oracle partitioning affects the design of database tables and their partitioning into multiple files. DB2 SMP partitioning simulates a "cluster in a box" where hardware or software allows multiple copies of DB2 to run in separate regions of memory, communicating to each other via TCP/IP. Both are separately charged features and included in this analysis.

required.[7] Oracle9iR2, in contrast, charges extra for clustered environments. For clustered environments, Oracle9iR2 requires the purchase of Enterprise Edition (EE), Partitioning, and RAC.

Second, DB2 UDB V8.1 and Oracle9iR2 charge differently for the standby server. DB2 UDB V8.1 charges for the standby server as if it were a one-way system, even if the standby has multiple CPUs. Oracle9iR2, on the other hand, charges for the idle standby in the normal way; that is, under per-processor pricing, Oracle9iR2 charges equally for active and for idle processors. As a result, Oracle9iR2 can cost up to four times as much as DB2 UDB V8.1 in larger configurations, and even more.

EURO PRICING

Both IBM and Oracle strive to maintain consistent list pricing[8] as well as terms and conditions around the globe. Nevertheless, the conclusions of this study may not apply in all geographies. The discrepancy arises in the conversion of dollar values to other currencies at any individual point in time. Both vendors base their regional pricing on a conversion rate at a particular point in time. Since the two vendors do not set their pricing on the same date, comparison pricing may vary among geographical locations.

The following table compares pricing for OLTP, data warehousing clusters, and data warehousing SMP using EURO currency. DB2 UDB V8.1 lists at less than Oracle9iR2 in all environments except one, and offers great savings when compared with Oracle's per-processor pricing.

Environment	DB2 UDB V8.1 Cost as a Percentage of Oracle9iR2 with 25 Named Users	DB2 UDB V8.1 Cost as a Percentage of Oracle9iR2 with Per-Processor Pricing	Breakeven
OLTP	118%	59%	30 users
Clustered Data Warehouse	93%	46%	23 users
SMP Data Warehouse	97%	48%	24 users

---

[7] Note that both Oracle9iR2 and DB2 UDB require the purchase of operating-system-dependent failover software such as HACMP or SunClusters.

[8] However, prices for consultant work may vary geographically, to reflect prevalent salary conditions.

CHAPTER 4: SERVICES

EXHIBIT 5:
Discounted Price with
One Year of Service –
DB2 UDB V8.1 ESE
vs. Oracle9iR2 EE
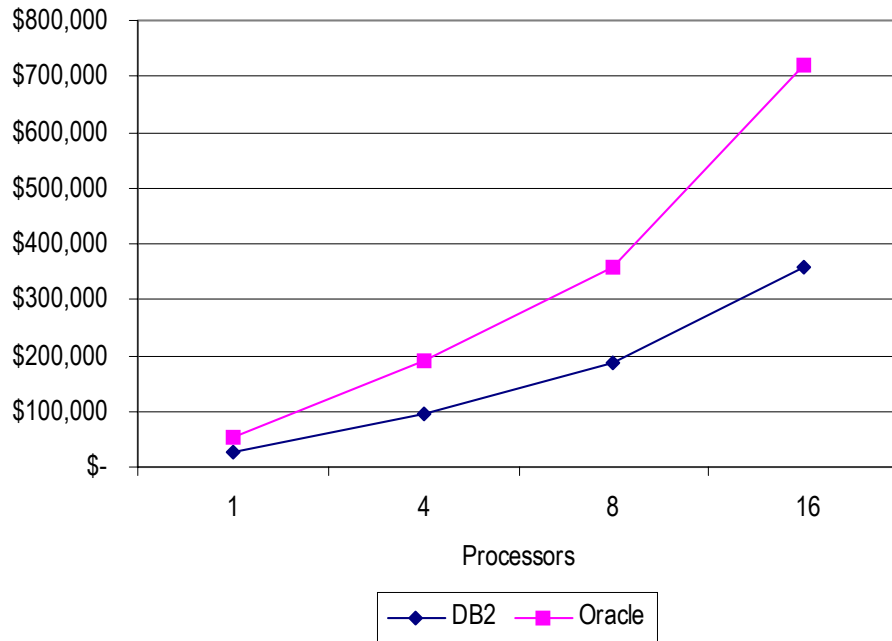
Even when service charges and discounts are applied to list prices, the comparative results remain similar. Calculating the bottom line for initial purchase of software and support, DB2 UDB V8.1 costs approximately half as much as Oracle9*i*R2, or even less, for configurations of over 50 users per processor. Substantial cost benefits occur as well when configuring 27 to 50 users per processor. The breakeven point is at 26 users per processor. Overall, five years of service doubles the price of the initial purchase. Exhibit 5 represents the per-processor cost for DB2 UDB V8.1 ESE vs. Oracle9*i*R2 EE. DB2 costs 49% – 54% of Oracle9*i*R2 when factoring in initial purchase of software and support, with discounts applied.

THE TERMS OF DISCOUNTS AND SUPPORT

Both DB2 and Oracle9*i*R2 require the purchase of one year of service.[9] DB2 UDB V8.1 policies[10] are somewhat more flexible in terms of technical contacts and are more forgiving when reinstating lapsed contracts. These differences are summarized in Exhibit 6.

---

[9]   Technically, Oracle service is optional but, since an update subscription is required for fixes, only the most daring customer would forego it. On the other hand, fixes are available to DB2 users beyond the one-year required service period, whereas Oracle provides fixes only to customers who have purchased an update license at 15% of purchase price per year.

[10]   Under Passport Advantage, the pricing model used in this study, support for one year or two years is automatically included in the contract price.

	DB2 UDB V8.1	**Oracle9*i*R2**
First Year Service	Mandatory	Virtually Mandatory
Subsequent Years Service	Optional	Virtually Mandatory
Reinstatement Fee	75%	150%
Fixes	Freely Available	Available Only with Update Subscription
Technical Contacts: Service Under $250,000	Flexible	One Primary, One Backup
Technical Contacts: Service Over $250,000	Flexible	Three Primary, Four Backup
Minimum Purchase Eligible for Discount	$2,000	$25,000

EXHIBIT 6:
Details of
Update/Service
Contracts

DB2 offers support and service through its Passport Advantage program. Passport Advantage simplifies the management of service contracts by providing a single contract to cover updates and technical support for DB2, WebSphere, Lotus, and Tivoli software products. Passport Advantage also offers additional discounts beyond the current invoice, since existing contracts are factored into the calculation of the total volume discount. Thus, the pricing information presented in this report represents the *minimum* discount for a particular purchase. The *actual* discount may be more, depending on the level of IBM distributed software already installed. Passport Advantage standardizes on 24x7 with complete update subscription.

Oracle9*i*R2 offers several layers of support. For the Enterprise Edition, it offers Product Support and Updates Subscription Service support. Oracle9*i*R2 charges 7% and 15%, respectively, for these services. Note that the higher price applies to software updates and fixes, which is a necessity with Oracle9*i*R2 since this subscription is a prerequisite for receiving fixes.

DB2 charges only 12.5% for the first year of service, giving relief to the high initial costs of purchase and design. DB2's rate of 25% for 24x7 service and upgrade subscription beyond the first year may seem a bit steeper than Oracle9*i*R2*'s*. However, DB2's product pricing is often half that of Oracle9*i*R2, so that the actual dollar cost for service is lower.

Furthermore, DB2 discounting may be even deeper than the representation in Exhibit 5. Under its current Passport Advantage service program, customer discounts include not just the current purchase but also purchase of distributed software (Tivoli, Lotus, WebSphere, and DB2) during the previous two years. In this way, a customer may qualify for a higher volume discount than is apparent on the current purchase.

Exhibit 7 provides representative pricing in U.S. dollars. For each license, it presents the list price and then the adjusted price. The adjusted prices reflect service charges and discounts for one year and five years, respectively. All examples include 24x7 support and upgrade subscriptions.

Licenses	List Price	Adjusted One Year	Adjusted Three Years	Adjusted Five Years
One-Way, Unlimited Users				
DB2 UDB V8.1	$25,000	$26,040	$37,665	$46,965
Oracle9*i*R2	$46,000	$53,314	$73,554	$93,974
DB2 UDB V8.1 Cost as a Percentage of Oracle9*i*R2	54%	49%	51%	50%
Four-Way, Unlimited Users				
DB2 UDB V8.1	$100,000	$94,080	$140,580	$187,080
Oracle9*i*R2	$184,000	$190,808	$271,768	$352,728
DB2 UDB V8.1 Cost as a Percentage of Oracle9*i*R2	54%	49%	52%	53%
Eight-Way, Unlimited Users				
DB2 UDB V8.1	$200,000	$188,160	$278,160	$368,160
Oracle9*i*R2	$368,000	$359,168	$521,088	$673,008
DB2 UDB V8.1 Cost as a Percentage of Oracle9*i*R2	54%	52%	53%	55%
Sixteen-Way, Unlimited Users				
DB2 UDB V8.1	$400,000	$358,400	$526,400	$ 694,400
Oracle9*i*R2	$736,000	$718,336	$1,042,176	$1,366,016
DB2 UDB V8.1 Cost as a Percentage of Oracle9*i*R2	54%	50%	51%	51%

***EXHIBIT 7.:
Representative
Pricing after
Discount and Service***

Both vendors also offer their technical expertise in the form of advanced, customized services. Prices for these services are negotiated on a case-by-case basis and, therefore, lie beyond the scope of this report.

CHAPTER 5: PACKAGING VALUE ANALYSIS

IBM augments DB2 UDB V8.1's favorable pricing strategy with beneficial product and feature bundling. These elements simplify the decision-making and purchasing process and save money for customers. The bundled selections augment the database experience and apply directly to database development and design. Oracle9*i*R2 also bundles functions and products with the DBMS. However, Oracle9*i*R2's selection of supplemental software is often tangential to the database experience and may be beneficial to only a small number of users. Paradoxically, it occasionally charges a supplemental fee for utilities and functions that would appear to be of interest to every user. Diagnostic and tuning utilities are examples.

EXHIBIT 8:
DB2 UDB V8.1
vs. Oracle9iR2 –
Bundled Features

Product/Capability	Oracle 9*i*R2	DB2 UDB V8.1
Diagnostics and Tuning Utilities	Charged Separately	Included
Data Extract and Transformation Wizards	Charged Separately	Included
Access to Mainframe DB2	Charged Separately	Included
OLAP	Charged Separately	Charged Separately
Development SDK	Charged Separately	Included
Queuing	Included	Included
"Workflow"	Included	Tangential[11]
Internet File System	Included	Tangential

DIAGNOSTIC AND TUNING UTILITIES

Oracle9*i*R2's Diagnostic Pack and Tuning Pack are packaged as add-on options, adding $120 per named user[12] or $6,000 per processor for the two packs. Together, these additional charges increase the software price by up to 15%. These options are included in the pricing that appears in the Appendix, since (1) DB2 provides equivalent function in the base product, (2) most users will choose to purchase them, and (3) their benefits are factored into the efficiencies analysis that appears in Parts III and IV of this study.

DATA EXTRACT AND TRANSFORMATION WIZARDS

DB2 UDB V8.1 ESE bundles the Data Warehouse Center for warehouse development and management. The Data Warehouse Center automates data warehouse processing, helping the DBA to:

- define the processes that move and transform data;

- schedule, maintain, and monitor these processes;

---

[11] That is, tangential to the database experience and may be beneficial to only a small number of users.

[12] Note that the number of named users for these packs must be equal to the total number of installed users. In other words, by named users Oracle includes not only the system administrators who actually use the utilities but also the end users whose systems are maintained with the packs.

- extract and move data from remote databases in flat files; and
- apply 150 transformations via SQL to the source data.

DB2 Warehouse Center comes free of charge with DB2 UDB V8.1. It is designed for use in conjunction with DB2's Data Warehouse Manager, an extra-cost bundle that includes the Query Patroller , QMF for Windows, and ETL agents which spread some of the ETL workload onto the source servers.

Oracle9*i*R2's Oracle Warehouse Builder (OWB) delivers function that is equivalent to the DB2 Warehouse Center as an extra-cost option. OWB is bundled with Oracle9*i*R2's Developer suite, which costs $5,000 per developer desk.

ACCESS TO MAINFRAME DB2

DB2 UDB V8.1 includes five mainframe registerd users per server, providing access to mainframe data using technology incorporated from DB2 Connect. If additional host access is required, DB2 Connect licenses are $3,000 per server and $299 per user. Oracle9*i*R2's gateway for accessing nonrelational data on mainframes, in contrast, costs $95,000.

OLAP

DB2 UDB V8.1 and Oracle9*i*R2 apply different packaging and pricing architectures for OLAP. Specifically, DB2 UDB V8.1 sells a separate product while Oracle9*i*R2 sells OLAP capability as an extra-cost option to the DBMS.

DEVELOPMENT SDK

DB2 UDB V8.1 bundles a copy of Developer Kit for Java Technology, Distributed Debugger for Java Stored Procedures, and WebSphere Studio Site Developer, so that programmers can immediately test out the product and evaluate its suitability for the organization, as well as its synergy with the DB2 DBMS. Oracle customers must order their development SDK separately.

QUEUING

DB2 UDB V8.1 bundles a complementary copy of WebSphere MQ (formerly MQSeries) that provides homogeneous queuing capability, so that the DB2 systems can receive incoming messages from MQ queues and send outgoing messages onto MQ queues. Full-function capability that extends beyond DB2 to heterogeneous systems and applications, however, requires purchase of the full WebSphere MQ product.

At first glance it may appear that Oracle9*i*R2 packages a complete queuing product with the DBMS. However, Oracle9*i*R2 queuing provides connectivity only among Oracle systems; it requires the purchase of either WebSphere MQ or

Oracle Message Broker to extend beyond its own application sphere. Thus, DB2 UDB V8.1 and Oracle9*i*R2 are equivalent in this regard.

"WORKFLOW"

Oracle9*i*R2 packages a copy of its Workflow software, native to the Application Server, with purchases of Oracle9*i*R2 DBMS as well. This software is only tangentially related to DBMS activity.

INTERNET FILE SYSTEM

In the development and management of its websites, Oracle9*i*R2 bundles its enhanced file system together with the DBMS workgroups. This type of software is only tangentially related to DBMS software and would be more appropriately packaged with an operating system or a toolkit for developing web content.

Part III: Efficiencies

CHAPTER 6: INTRODUCTION TO EFFICIENCIES

EXHIBIT 9:
DBA Activites,
Weighted by
Application Type

Activity	OLTP Percentage of Total Effort	Internet Percentage of Total Effort	Data Warehousing Percentage of Total Effort	Large OLTP Percentage of Total Effort
Database Development Tasks				
Installation and Update	1	1	1	1
Planning and Modeling	15	10	15	15
Coding and Debugging	10	10	5	10
Staff-Related Activities	10	10	5	10
Query Optimizations	10	10	10	10
Data Movement	0	5	10	0
Change Management	10	10	5	10
Distributed Database	0	0	5	0
Application-Specific Details	4	4	4	4
Routine Administration and Operation				
System Monitoring and Troubleshooting	20	20	15	20
Routine Operations	15	15	10	15
Query Governance	0	0	10	0
Staff-Related Activities	5	5	5	5

Part III of this paper evaluates the DBA tools and facilities of each DBMS to determine their impact on the manpower required to staff a project. This determination requires a model that estimates the percentage of time devoted to individual tasks. Individual projects can vary greatly from this model, depending on project size, complexity, existing information resources, expertise of personnel, etc.

The level of benefit derived from tools automation varies by application and environment. For example, data movement might constitute up to 10% or more of the design effort in a data-warehousing system but may be completely absent in an OLTP application. For this reason, we have provided separate time estimates based on four environments: OLTP, Large OLTP, Data Warehousing, and Internet.

Exhibit 9 presents the model used for this study. The "Activity" column lists the major activities in database development, administration, and operation. The "Percentage of Total Effort" columns indicate how much effort is devoted to a

particular task. The columns total 100%. Chapters 7 and 8 describe these activities in more detail, calling out specific tasks when they are particularly time-consuming and/or when the DBMS vendors have provided noteworthy automation. Exhibit 9 is also the basis for estimating the work effort for the scenarios that appear in Part IV.

Note that the planning and modeling stages of development, consuming 10% – 15% of the total project time, are DBMS-independent; this expense is incurred irrespective of the DBMS used. Staff-related activities – scheduling, briefing, synchronizing, training, etc. – are also somewhat DBMS-independent, though DBMS efficiencies can reduce training and coordinating costs to some degree. Staff-related activities consume an additional 5% – 10% of the project development and maintenance budget. Of the remaining activities, data-movement routines are the most manpower-intensive for data warehousing and Internet applications, whereas they assume lesser importance in OLTP and large OLTP environments. For the purposes of this study, distributed database activities are significant only in data-warehousing applications. Customers may wish to adjust the percentages to suit their own circumstances.

The estimates presented here and in the following chapters are extrapolated from dozens of interviews with database developers and consultants. Readers can modify the model to more closely reflect their individual installations, personnel, and projects.

CHAPTER 7: COST ANALYSIS – DATABASE DEVELOPMENT

Activity	DB2 UDB Efficiency (%)	Oracle9*i* Efficiency (%)
Database Development Tasks		
Installation and Update	50	Included in Base Level
Planning and Modeling	0	30
Coding and Debugging	50	Included in Base level
Staff-Related Activities	25	Included in Base Level
Query Optimizations	50	Included in Base Level
Data Movement	Included in Base Level	30
Change Management	Included in Base Level	40
Distributed Database	50	Included in Base Level
Application-Specific Details	Included in Base Level	Included in Base Level

Oracle9*i*R2 and DB2 UDB V8.1 both provide a full range of tools to support the development effort. While tools from the two vendors may resemble one another for some individual tasks, in other cases they vary substantially. When considerable difference exists between the two vendors, it can often be attributed to a difference in the target user. In general, DB2 tools provide a greater level of automation, shielding the DBA from much technical complexity, ultimately delivering greater efficiency, reducing training costs, and cutting TCO. In this way, DB2 creates an environment where moderately skilled DBAs can perform many tasks otherwise delegated to highly experienced and technically astute DBAs. For example, DB2's advanced query optimizer provides sufficient performance to eliminate the need for manual optimization in 85% of situations, according to a prominent DBA practitioner and consultant.

Among development tasks, DB2 UDB V8.1 delivers a 50% advantage in installation and update, query optimizations, and distributed database. DB2 UDB V8.1 delivers a 25% advantage in staff-related activities by reducing the effort of training and coordination. Probably most significant is DB2 UDB V8.1's advantages in the Coding and Debugging category, where the new Development Center's comprehensive functionality and superior interface give it a 50% advantage over Oracle9*i*R2. Oracle9*i*R2 balances these efficiencies somewhat with a 40% streamlining of the change management effort and by a 30% reduction of the data movement effort by means of a utility called Transportable Tablespaces.

The impact of these efficiencies on the bottom line varies greatly, depending on the size and nature of the project. To determine overall efficiency, one must combine these results with the weights presented in the Methodology chapter. This process is completed in the section that covers the scenarios. Chapter 9 of

this report factors in the weighted efficiencies along with costs of software and service.

INSTALLATION

Oracle9*i*R2 is notoriously difficult to install. The Real Application Clusters (RAC) – previously Parallel Server (OPS) in particular will require many low-level operations that are error prone. To install RAC, the DBA must create raw devices for all files. The DBA must then create an ASCII file that lists each database object and the corresponding raw device file name, and then set an environmental variable to point to the ASCII mapping file. Following these steps, the DBA then creates a UNIX account on each node, creates a mount-point directory on each node, and then sets up users and replicates to all nodes. Even for single-system installations, Oracle9*i*R2 requires the DBA to set operating-system parameters by following a difficult and lengthy set of instructions in the documentation.

DB2 UDB V8.1 ESE with the Database Partitioning Feature option, in contrast, presents a single-system image and centralized management of all nodes along with an automated installation procedure. The DBA inserts the CD, runs setup on one database partition server, and then copies to all the others, adding logical nodes as appropriate. On single-node systems as well as multi-node systems, the DBA modifies system parameters with the assistance of a clearly laid out chart and one line of syntax documented in the administrator's manual. It is estimated that a DB2 UDB V8.1 installation requires about one-third the person-hours of an equivalent Oracle9*i*R2 multi-system installation.

PLANNING AND MODELING

Planning and modeling consumes 10% – 15% of the total effort of database creation, administration, and operation, on average. DB2 UDB V8.1 ESE with the Database Partitioning Feature requires a bit more work to co-locate data in its shared-nothing environment, This extra effort is not required in a single-partition environment, however. Otherwise, planning and modeling tasks are database-independent and hence, equivalent for both DBMSs.

CODING AND DEBUGGING

Both Oracle9*i*R2 and DB2 UDB V8.1 provide graphical templates, or wizards, for creating and updating database objects. These tools include a graphical template for creating stored procedures and user-defined functions (UDFs) in both SQL and Java. Oracle9*i*R2 provides these facilities in its SQL Scratchpad and in the Schema Management module of its Enterprise Manager. DB2 provides these facilities in the Development Center, which is included with the DBMS at no extra charge.

The DB2 Development Center resembles an IDE and prompts the programmer for the various parts of a stored procedure – error handling, exception handling,

etc. Its wizards provide support for in-house conventions and standards, so that they can be automatically applied for every stored procedure uniformly. It also has wizards for maintenance (Import, Export, Deploy) of stored procedures and UDFs. Its advanced debugging environment allows the programmer to specify breakpoints for specific iterations within a loop and to trace variables in a table. It allows programmers to change variable values during a debugging session. Visibility on the screen is excellent, so that the programmer can simultaneously view all of the necessary information on a single screen. The DB2 Development Center for building stored procedures can be invoked directly or from within WebSphere Studio and Microsoft Visual Studio, where it takes on the look-and-feel of the development environment in which it appears.

Oracle9iR2 DBMS, in contrast, does not provide an integrated graphical environment for developing and debugging triggers or stored procedures. Instead, functionality is distributed across several facilities such as the SQL Scratchpad and the Enterprise Manager's Schema Management module. More important, its several packages to aid debugging – DBMS_DEBUG and DBMS_DEBUG_JDWP, for example – are more suitable for building a debugger than for direct use in debugging a trigger or stored procedure. When Oracle9iR2 customers wish to provide their programmers with a good development and debugging environment for stored procedures, they can purchase the Oracle Internet Developer Suite at a cost of $5,000 per user.

STAFF-RELATED ACTIVITIES

DBAs engage in many staff-related activities: attending meetings, coordinating and scheduling tasks, as well as receiving and delivering training. For the most part, these activities are DBMS-independent. However, automation of tasks can reduce the amount of training required, and workflow features can reduce the effort of coordinating the work of multiple staff members. In general, DB2's graphical interface provides a greater level of automation for system-administration tasks than Oracle9iR2 and, in addition, guides the DBA through a sequence of steps. It is estimated that the DB2 UDB V8.1 style can reduce staff-related activities by up to 25%.

QUERY OPTIMIZATION

In query optimization, DB2's cost-based optimization is more mature than Oracle9iR2's. As a result, DB2 has a more complete set of optimization strategies and techniques, so that its optimizations cover a broader range of special situations, and has addressed a greater number of specific situations that will slow down a system. Hence, in certain instances the DB2 UDB V8.1 query operation can complete orders of magnitude faster – one hour instead of ten, etc. In terms of savings in personnel costs, the more advanced optimizer can save the DBA hours of tuning, exploration, and redesign to discover an approach that can fit within the maintenance window. It is estimated that DB2's superior query optimizer cuts in half the total query-optimization effort.

DATA MOVEMENT

Both systems support a choice of several load utilities that include parallel load, fast load, etc. Loading the data is a time-consuming process, particularly defining the targets and sources, and also in designing the load process so that it completes within the maintenance window assigned to it. DB2 offers a mature set of utilities for this purpose, and has a reputation for very fast loads. Its Copy Table automates elements of data movement that previously required detailed manual instructions. The DB2 Data Warehouse Center provides a framework and GUI for defining and maintaining ETL functions in the warehouse.

Oracle9*i*R2 essentially matches these capabilities. In addition, however, it offers a facility called Transportable Tablespaces that enables rapid direct data movement between Oracle databases. Its use, however, is restricted as follows:

- The Transportable Tablespace mechanism is designed for moving complete tables from one database to another without transformation.

- Source and destination must use the same operating system and platform. This restriction eliminates its use for copying data from Windows NT/2000 to a UNIX platform, for instance.

- Block size of source and destination databases must be identical.

- Transportable Tablespaces are not as fast as DB2 load utilities, hence they are not suitable for the largest databases that must be transported within a defined time window.

In view of these restrictions, it is estimated that Oracle9*i*R2 reduces the cost of developing data-loading routines by 30%.

CHANGE MANAGEMENT

DBAs spend about 30% of their time propagating changes made during the development and testing phases. For example, if a data column is moved from one table to another, the change must be recorded throughout the system to the index structures, table views, stored procedures, load routines, backup routines, etc. Often the structure of the database can be modified several times during the development and testing phases, and these changes must be replicated out to all affected objects. Oracle9*i*R2 automates the process of change management, relieving the DBA of most of this burden. It is estimated that Oracle9*i*R2's Change Management Utility reduces by half the amount of time dedicated to cleanup. Note that the change-management feature is an extra cost item that must be reconciled into the TCO, offsetting some of the productivity gain in the TCO picture. Oracle9*i*R2 charges $3,000 per processor for the Change Management Utility. (Please note: this option was not included in the pricing schedules that appear in the Appendix.)

DISTRIBUTED DATABASE

While both DBMSs claim to define an object-based environment for defining joins and links, DB2 UDB V8.1 delivers a better architecture for defining the relationships among objects across multiple databases, both native DB2 and non-DB2 databases. DB2's vocabulary allows the DBA to create *servers*, *wrappers*, and *function mappings*, and then to define the relationship among them. In this way, non-DB2 data appears to users as if they were local DB2 tables. This architecture promotes reuse, eliminates redundancies, and streamlines the process of making changes. Oracle9*i*R2's *create database link* syntax, in contrast, requires the DBA to create more links and is less conducive to reuse. Furthermore, Oracle9*i*R2 requires the DBA to create and maintain ASCII files for each link. A 20% initial benefit is estimated for DB2, growing to 50% or more as the distributed environment grows and is modified over time.

APPLICATION-SPECIFIC DETAILS

For the purpose of this study, it is estimated that 4% of the development effort is devoted to application-specific details that cannot be evaluated here.

CHAPTER 8: COST ANALYSIS – ADMINISTRATION AND OPERATION

Activity	DB2 UDB V8.1 Efficiency (%)	Oracle9iR2 Efficiency (%)
Tuning, Monitoring, and Troubleshooting	25	10
Routine Operations	10	Included in Base Level[13]
Query Governance	30	NA
Staff-Related Activities	20	Included in Base Level

DB2's administration interface is increasingly designed at the conceptual level (i.e., a "higher level of abstraction"), enabling less experienced DBAs, as well as DBAs who are experienced with other platforms, to perform more operations with less training. For example, the DBA can choose between a space management system that is low maintenance as compared to one that is high performance. DB2 will automatically implement the selected policy; the DBA need not be concerned with the details of setting up such an environment. At the same time, DB2 provides a full range of statistical, reporting, and editing tools for modifying the database environment when expert, manual intervention is required.

Furthermore, DB2 UDB V8.1 often applies a greater level of automation to its utilities than an equivalent Oracle9iR2 counterpart. For example, the Health Center automatically implements an event notification system, with automatic assignment of thresholds for generating alerts. With this automatic configuration and notification policy, DB2 UDB V8.1 participates in IBM's overarching SMART (Self Managing and Resource Tuning) initiative for autonomic computing. Similarly, DB2 UDB V8.1 automatically deploys many of the database objects for which Oracle9iR2 requires a manually written control file – a labor-intensive and error-prone activity.

Many Oracle9iR2 tools, in contrast, are designed with the highly experienced DBA in mind. Particularly in its enterprise management tools, Oracle Enterprise Manager provides a consistent environment for such tasks as manual parameter tuning and manual query optimization. Certainly, Oracle9iR2 does support the less experienced DBA with wizards and tools for relatively simple and repetitive tasks. However, in general its tools do not customize the DBMS environment based on a specification of desired outcomes.

---

[13] Both Oracle9iR2 and DB2 UDB V8 are mature products that provide much support and automation for many DBA tasks. One need only think back to the administrative taskload of early relational DBMSs to appreciate the level of sophistication that has been achieved. The phrase "included in base level," therefore, reflects this support and automation as well as DBA tasks. It means that, in determining the scoring for the efficiencies, we lined up the functionality provided by each product and crossed off the equivalent functionality. The numbers in this chart, therefore, represent the exceptions, or distinguishing characteristics, of each product.

The DB2 UDB V8.1 approach yields more cost-effective results. Experienced DBAs have access to a full range of tools for fine-tuning performance and managing resources manually. At the same time, less experienced users can achieve respectable results and a well-managed installation by using the automated facilities. The team leader can assign the most critical tasks for manual administration while less critical tasks can be assigned to newer personnel using the automated facilities. DB2's greater level of automation enables more tasks to be successfully handled by DBAs with lesser training. A 25% advantage in monitoring activities is estimated, as well as a 10% reduction in routine operations, and a 20% reduction in staff training and coordination. In addition, the DB2 Query Governor reduces by up to 30% the amount of time devoted to handling individual user requests. Oracle9iR2, in turn, provides a 10% efficiency advantage in system monitoring and troubleshooting.

The impact of these efficiencies on the bottom line varies greatly, depending on the size and nature of the project. To determine overall efficiency, one must combine these results with the weights that are presented in the Methodology chapter. Chapter 9 of this report factors in the weighted efficiencies along with costs of software and service.

TUNING, MONITORING, AND TROUBLESHOOTING

In the area of system monitoring and troubleshooting, DBAs handle user-specific and application-specific problems. They determine the problem, isolate the problem, examine memory, storage, and process statistics to isolate and improve the situation.

Both Oracle9iR2 and DB2 UDB V8.1 provide a range of tools to support this effort. The DBA can look at performance monitors, configuration and tuning parameters, log files, event logs, statistics about resource consumption, and so on. Both products present a hierarchical view of the database through object trees. The two DBMSs provide a similar range of tools and graphical interfaces for performing routine operations such as backup, disk replacement, schedule operations, defragmentation, gathering statistics to refresh the optimizer, etc. Oracle9iR2's diagnostic and performance tuning options provide advanced editors, with sorting and filtering options, for performing these tasks in an elegant environment.[14]

Over the past couple of years, both products have come a long way in automating DBA tasks that were previously done manually. They have raised the bar on automation of DBA tasks, with the ultimate goal of self-managing systems. Recent innovations from both vendors address such time-consuming DBA problems as managing free space, reducing the need for *reorg*. Both advise users on when to gather statistics for the optimizer. Both also provide aids to memory management. Both support clustered tables, wherein related tables are

---

[14] Note that the additional prices for Oracle9i's performance and diagnostic packs are NOT included in the list prices that appear in the Appendix.

co-located physically close to one another on the disk, with the effect of reducing the number of reorgs that would otherwise be necessary. Both provide Configuration Advisors that suggest a high-performance database configuration based on database design and workload.

DB2 UDB V8.1 brings new levels of self-monitoring capability to the system, supplementing existing 8.1 capability with a new Health Monitor that operates through a Health Center GUI and Health Beacon. The new health system automatically monitors each instance, proactively reporting out-of-threshold values to the specified recipient, offering recommended actions, and optionally executing the recommended action. The health system installs along with DB2 UDB V8.1 and requires no effort whatsoever on the part of the DBA. The Health Center has the potential to dramatically improve cost of ownership by replacing human monitoring by up to 75% in future releases. Since it is currently in first release, however, we assign only a 5% efficiency improvement to the Tuning, Monitoring, and Troubleshooting activity.

DB2 UDB V8.1 brings new levels of self-tuning as well. The expert engine in its newly improved Configuration Assistant can, in some cases, configure and tune the database to within 90% – 120% of the performance achieved by a human expert, providing a true decrease in cost of ownership.[15] This innovative technology may lead to a completely automated, self-tuning facility.

Oracle9*i*R2 similarly provides an event system, but in Oracle9*i*R2, the DBA must define the objects to be monitored and set the thresholds to be observed. These tasks require the attention of highly experienced DBAs, possibly distracting their attention from more strategic corporate activities.

The DB2 UDB V8.1 GUI interface often presents a goal-oriented choice to the DBA, whereas Oracle9*i*R2 might in the same situation present the DBA with a list of parameters to edit. For example, DB2 UDB V8.1 prompts the DBA to choose between maintenance-oriented space management and performance-oriented space management. On the same screen, DB2 UDB V8.1 explains the action in technical terms, so that the experienced DBA gets a precise definition. Oracle9*i*R2 DBAs do not receive this level of support; instead of specifying goals, they must design these features at a more technical level. This orientation provides an estimated 25% advantage for DB2 UDB V8.1 in system monitoring and troubleshooting.

---

[15] The greatest benefit is achieved, of course, where the characteristics of the particular DBMS match the DBMS's intelligence. For example, the DB2 Configuration Advisor is programmed to tune the database based on the following criteria: workload type (DSS, OLTP), average number of statements per unit of work (>< 10 statements), number of connected local applications, number of remote applications, isolation level (row locking), and DBA priority (faster transaction performance, faster database recovery, or something in between).

ROUTINE OPERATIONS

DBAs do backup, replication, data movement activities, schedule reports and other jobs, generate reports at specific time intervals or on a custom basis, and make sure that these routine operations complete successfully. Both products offer graphical interfaces for defining and maintaining these tasks. Both products have mature tools that work well to streamline the DBA effort. In this area, greater automation gives DB2 UDB V8.1 a 10% efficiency advantage.

QUERY GOVERNANCE

DB2's Query Patroller enables business analysts to self-manage many information requests that would otherwise require the aid of a professional. It streamlines the DBA's workload by enabling self-management by end users. Targeted specifically for business analysts, IBM has created a tool that lets business analysts monitor, schedule, and retrieve their own queries. This leads to a great deal of end-user satisfaction and saves the DBA staff a lot of time. While no user can be totally self-sufficient, the Query Patroller enables the end user to self-manage in a large number of cases. In addition, DB2's Query Patroller provides valuable capabilities for prioritizing and scheduling that help to manage a large number of concurrent users in data-warehousing applications.

Furthermore, the Query Patroller provides real-time metrics about queries directly, rather than in terms of session information. Query Patroller can monitor and examine the status of the query in a natural and intuitive fashion, suitable for end users. Query Patroller reduces the number of individual requests by an estimated 30%. At the present time, Query Patroller is packaged with the Warehouse Manager, a bundle of tools and facilities that aid in the creation and maintenance of data warehouses. This product costs $10,500, and so it may not be available in all installations.
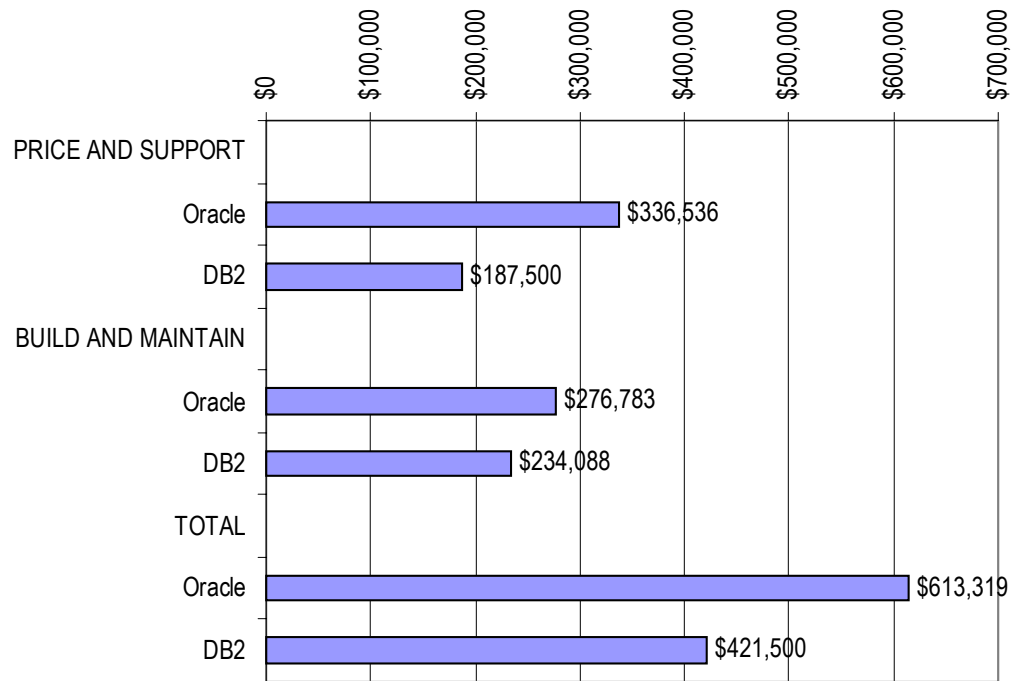
STAFF-RELATED ACTIVITIES

In staff-related activities, DB2's greater level of automation for ongoing maintenance can reduce meeting, scheduling, and coordination tasks by up to 20%.

Part IV: Scenarios

CHAPTER 9: SCENARIOS

Part III of this report highlighted specific efficiencies that differentiate Oracle9*i*R2 from DB2. This chapter evaluates the impact of these efficiencies on the TCO over a five-year period. The analysis evaluates the effect of DB2 UDB V8.1 and Oracle9*i*R2 in three different scenarios: four-way OLTP, 64-way OLTP, and Internet. Work-effort calculations are derived from combining the data in chapters 6, 7, and 8. Readers are invited to create personalized scenarios for planning their database projects.

EXHIBIT 12:
OLTP Scenario

|	
PRICE AND SUPPORT	
Oracle	$336,536
DB2	$187,500
BUILD AND MAINTAIN	
Oracle	$276,783
DB2	$234,088
TOTAL	
Oracle	$613,319
DB2	$421,500

The four-way OLTP system RDBMS will reside on a four-way, 500 MHz RISC system with 50 GB of disk space, 200 users, service contracts for software upgrades, and 24x7 coverage. The work effort for database creation is estimated to be a 13-week project to be built in-house by one DBA earning $104,000 per year along with three programmers and modelers who earn $78,000 per year. After the initial build, the system will require a half-time DBA earning at an annual full-time rate of $78,000, supervised by a $104,000 DBA who devotes 20% of work time to the project.

In this scenario, DB2 UDB V8.1 holds a cost advantage in all of the expense categories evaluated – software, services, development, and maintenance. DB2 UDB V8.1's software and services, the greatest source of savings, cost only 56% of Oracle9*i*R2's. This strong price advantage is augmented by a 15% savings in

the costs to build and maintain. Overall, for this OLTP scenario, total expenses for the DBMS over five years cost only 69% of the same project implemented with Oracle9iR2.

EXHIBIT 13:
Large OLTP Scenario
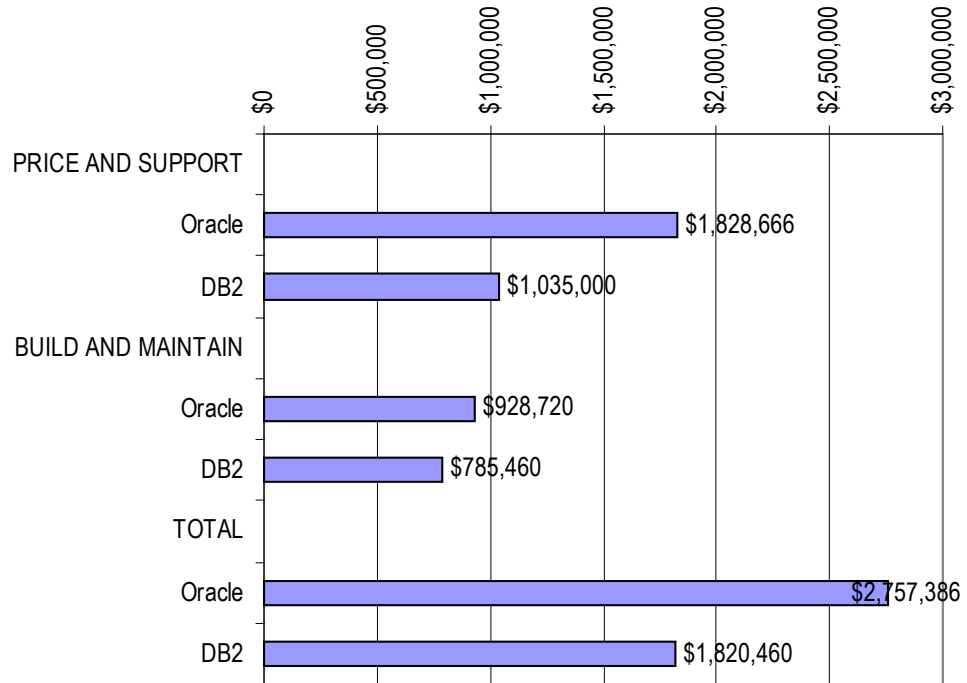
The large OLTP system RDBMS will reside on a 64-way 600 MHz RISC system with 2 TB of disk space, three million transactions per day, 2,200 users, service contracts for software upgrades, and 24x7 coverage. The work effort for database creation is estimated to be a 26-week project to be built in-house by one DBA earning $104,000 per year along with three programmers and modelers who earn $78,000 per year. After the initial build, the system will require one full-time DBA earning $78,000 per year plus one full-time DBA earning $104,000.

In this scenario, DB2 UDB V8.1 holds a cost advantage in all of the expense categories evaluated – software, services, development, and maintenance. DB2 UDB V8.1 software and services cost only 57% of Oracle9iR2's. This database is characterized by large volume but simple logic, so that personnel costs account for less than half of the total expense. Overall, for this large OLTP scenario, total DB2 UDB V8.1 expenses over five years cost only 66% of the same project implemented with Oracle9iR2.

EXHIBIT 14:
Internet Scenario
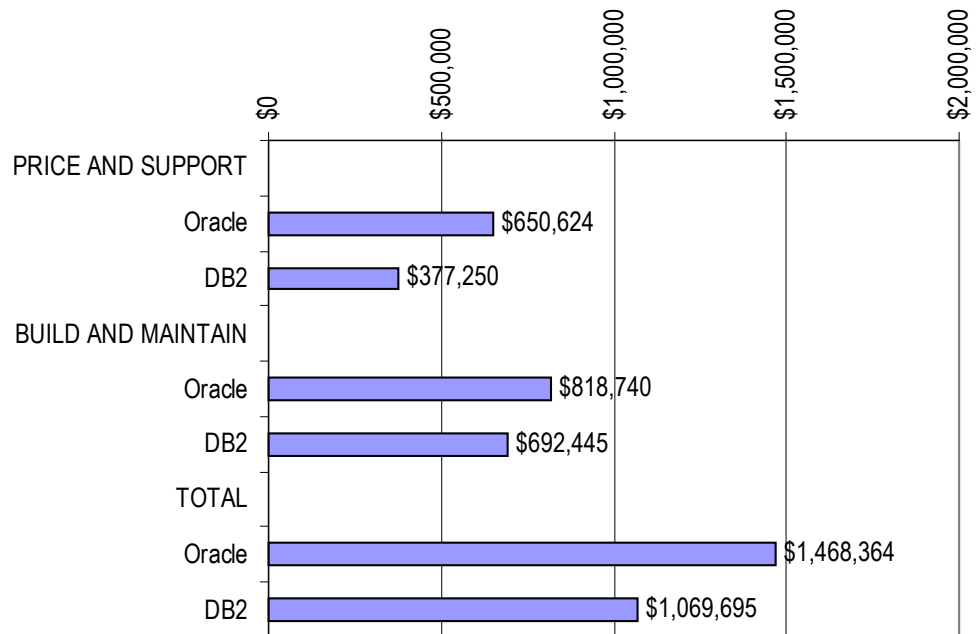
The web-enabled database system will reside on a four-way 500 MHz RISC system with 50 GB of disk space, unlimited users, service contracts for software upgrades, and 24x7 coverage. The work effort for database creation is estimated to be a 13-week project to be built in-house by three DBAs earning $104,000 per year along with five programmers and modelers who earn $78,000 per year. In addition, one consultant at $1,500/day and one consultant at $2,000/day will participate in the project. After the initial build, the system will require one full-time DBA earning $78,000 per year plus one full-time DBA earning $104,000.

In this scenario, DB2 UDB V8.1 holds a cost advantage in all of the expense categories evaluated – software, services, development, and maintenance. DB2 UDB V8.1's software and services, the greatest source of savings, cost only 58% of Oracle9iR2's. In spite of the large cost of personnel, where DB2 UDB V8.1 provides a 15% savings by virtue of its efficiencies, total DB2 UDB V8.1 expenses over five years cost only 73% of the same project implemented with Oracle9iR2.

The data warehousing system RDBMS will reside on a six-node four-way 600 MHz RISC system with 1TB of disk space, 200 users, and service contracts for software upgrades and 24x7 coverage. The work effort for database creation is estimated to be a 52-week project to be built in-house by three DBAs earning $104,000 per year along with eight programmers and modelers who earn $78,000 per year. In addition, one consultant at $1,500/day and one consultant at $2,000/day will participate in the project. After the initial build, the system will require two full-time DBAs earning $78,000 per year plus one full-time DBA earning $104,000. This scenario supports the following query mix:

- Sixty percent short-running queries with up to one minute response time.

- Thirty percent medium-running queries with one- to five-minute response time.

- Ten percent long-running queries with greater than five minutes response time.

EXHIBIT 15:
Data Warehousing
Scenario
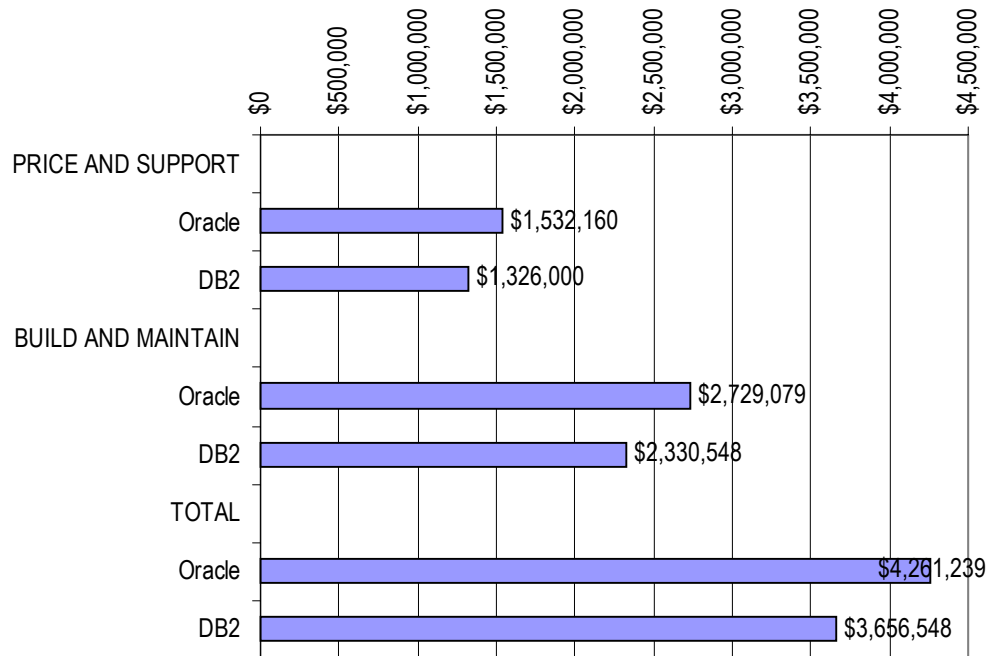
This scenario presents a highly CPU-intensive application. As a result, the number of users per CPU is quite small – less than ten users per CPU. In this situation, Oracle can apply its named user pricing with the minimum 25-user/CPU entry point. In this scenario, DB2 UDB V8.1 costs 87% of Oracle9*i*R2 for software[16] and support. DB2 also retains a cost advantage in person-power of 15% derived from built-in efficiencies. This advantage persists even after incrementing DB2 manpower requirement in the design phase for co-locating data on a manual basis. Overall, for this scenario, DB2 UDB V8.1 holds an advantage of 14%.

---

[16] Oracle software includes Enterprise Edition, Real Application Clusters, and Partitioning, Diagnostic Pack, and Tuning Pack. IBM software includes DB2 UDB Extended Server Edition V8.1 with Database Partitioning Feature.

Appendix: Pricing Schedules[17]

PRICING SCHEDULE 1: Named User Prices per CPU – DB2 UDB ESE V8.1 vs. Oracle9iR2 EE

Users/CPU	DB2	Oracle9iR2
10	$25,000	$23,000
25	25,000	23,000
50	25,000	46,000
75	25,000	46,000
100	25,000	46,000

NOTES

- For Oracle9iR2 pricing, we list either per-user or per-processor pricing, whichever is cheaper. Oracle9iR2 charges a minimum of 25 users per processor.

- Oracle9iR2 pricing includes Diagnostic and Tuning Packs.

- The DB2 UDB V8.1 prices are "reference" prices. These prices serve as the basis for calculating discounts and service under Passport Advantage.

PRICING SCHEDULE 2: Named User Prices per CPU – DB2 ESE V8.1 vs. Oracle9iR2 (Data Warehousing Clustered)

Users/CPU	DB2	Oracle9iR2
10	$32,500	$38,000
25	32,500	38,000
50	32,500	76,000
75	32,500	76,000
100	32,500	76,000

NOTES

- DB2 includes ESE with the Database Partitioning Feature option.

- Oracle9iR2 includes Enterprise Edition, Tuning and Diagnostic Packs, Partitioning, and Real Application Clusters (RAC).

- For Oracle9iR2 pricing, we list either per-user or per-processor pricing, whichever is cheaper. Oracle9iR2 charges a minimum of 25 users per processor.

---

[17] Prices are current as of August 2002 and are subject to change without notice.

PRICING SCHEDULE 3: Named User Prices per CPU – DB2 ESE V8.1 vs. Oracle9*i*R2 (Data Warehousing SMP)

	DB2 UDB V8.1	DB2 UDB V8.1w/Partitions	Oracle9*i*R2
10	$25,000	$32,500	$28,000
25	25,000	32,500	28,000
50	25,000	32,500	56,000
75	25,000	32,500	56,000
100	25,000	32,500	56,000

NOTES

- DB2 UDB V8.1 includes ESE with the Database Partitioning Feature option.

- Oracle9*i*R2 includes Enterprise Edition, Tuning and Diagnostic Packs, and Partitioning.

- For Oracle9*i*R2 pricing, we list either per-user or per-processor pricing, whichever is cheaper. Oracle9*i*R2 charges a minimum of 25 users per processor.

PRICING SCHEDULE 4: Per Processor Pricing: CPU – DB2 ESE V8.1 vs. Oracle9*i*R2 (Scalability Clusters with Idle Standby)

Processors	DB2 UDB V8.1	Oracle9*i*R2
1+1	$65,000	$152,000
4+4	162,500	608,000
8+8	292,500	1,216,000
12+12	422,500	1,824,000
16+16	552,500	2,432,000
20+20	682,500	3,040,000
24+24	812,500	3,648,000

NOTES

- DB2 UDB V8.1 includes ESE with the Database Partitioning Feature option.

- Oracle9*i*R2 includes Enterprise Edition, Tuning and Diagnostic Packs, Partitioning, and RAC.

PRICING SCHEDULE 5: Selected U.S. and EURO Prices – DB2 UDB V8.1

Product	U.S. Dollars	EURO
Enterprise Server Edition	$25,000	€29,493
Partitioning Feature	7,500	8,848
Warehouse Manager	10,500	12,387

NOTES

- Source: IBM U.S. Marketing.

- Prices valid as of September 2002.

- Discounts and service charges are billed under the same Terms and Conditions worldwide. Proportional differences in price are the same or similar.

- Relational Connect is priced per datasource. Other prices are per processor.

PRICING SCHEDULE 6: Selected U.S. and EURO Prices – Oracle9iR2

Product	U.S. Dollars		EURO	
	Named User	Per Processor	Named User	Per Processor
Enterprise Edition	$800	$40,000	€869	€43,440
Diagnostic Pack	60	3,000	65	3,258
Tuning Pack	60	3,000	65	3,258
Change Management Pack	60	3,000	65	3,258
Real Application Clusters	400	20,000	4,347	21,720
Partitioning	200	10,000	217	10,860

NOTES

- Source: Oracle9iR2 Price List of September 2002.

- Discounts and service charges are billed under the same Terms and Conditions worldwide.