# *DB2 UDB vs. Oracle8i:*
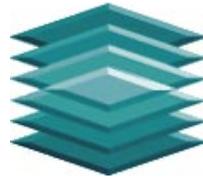# *Total Cost of Ownership*
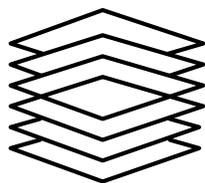
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December 2000

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# *DB2 UDB vs. Oracle8i: Total Cost of Ownership*

# CHAPTER 1. EXECUTIVE SUMMARY

As classical brick-and-mortar companies hasten towards e-business at a dizzying pace, many are focusing their attention on technology and ignoring the total cost associated with the products they are purchasing. In the end, they may face unplanned costs that could negatively affect the bottom line and compromise the overall financial health and success of their companies. Of the .com companies that have disappeared, some have succumbed to wrong, costly technology decisions.

To help provide an understanding to this environment, D.H. Brown Associates, Inc. (DHBA) has evaluated two of the leading Internet platforms – IBM's DB2 Universal Database and Oracle's 8i – in terms of four expense categories: software, service, development, and maintenance. DHBA concludes that the two products provide functionally equivalent technologies, but they vary significantly in total cost of ownership. While the weight of these expense categories may vary by customer environment, requirements, and applications, DB2's advantages in all categories suggest that it is the more economical choice in five-year cost-of-ownership for almost all scenarios.

The major conclusions derived from this study were,

### SOFTWARE PRICING

In each of the scenarios (Internet, data warehousing, OLTP – see chapter 8) the price advantages for DB2 UDB were pronounced. DB2 UDB holds a strong price advantage for almost all systems running over 500 MHz, often costing half the price of Oracle's or less. The area of greatest price advantage is undoubtedly the Internet, where Oracle8i's mandatory unlimited-user license costs several times that of their named user pricing. In this situation, Oracle8i's price is three to five times that of DB2 Universal Data Base Enterprise Edition (DB2 UDB EE) 7.1.

### SERVICE PRICING

Service pricing carries forth the DB2 UDB pricing advantage. Five-year 24x7 support with upgrade subscription essentially doubles the license price for both products. As a result, the total price benefits delivered in DB2 UDB double when one factors in the price of service. Furthermore, DB2 UDB offers two less expensive options. First is 8x5 support, allowing customers to call eight hours a day, five days a week. Second, customers can decline the upgrade subscription and still receive fixes free of charge. On Oracle8i, by comparison, upgrade

protection is virtually mandatory, since it is the only way customers can receive bug fixes and patches.

## PACKAGING

DB2 UDB sweetens the pot even further by bundling products for business intelligence, mainframe connectivity, and Internet support into the base product price. Altogether, these options can be valued at $35,000 or more, depending on size of installation. More important, they can provide valuable efficiency and experience for low-volume tasks, where purchase of the tool would otherwise not be considered.

## EFFICIENCIES

DBA efficiencies complement the DB2 UDB pricing advantages. Both DB2 UDB and 8i are mature products that automate many DBA tasks. Even so, DB2 UDB exceeds Oracle8i in its installation routine, query optimization, architecture for distributed database, and query governance. Oracle8i only partially offsets these efficiencies with its data movement and change management facilities. The DB2 UDB 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 Oracle8i. On average, DB2 UDB efficiencies yield an overall reduction in the work effort of 6% for OLTP systems, 15% for large OLTP systems, 20% for Internet-enabled databases, and 18% for data warehousing.
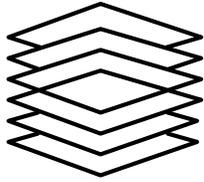
*PART I.*

# Pricing and Packaging

## CHAPTER 2. PRODUCT PRICING

### SUMMARY

DB2 UDB customers expect the clarity, simplicity, economy, and efficiency of IBM's per-processor pricing model, which is easy to understand. Users can easily predict or estimate the cost of system enhancements and upgrades. It eliminates the cost of maintaining and enforcing per-user licensing constraints. Most important, DB2 UDB is priced for easy scalability.

Oracle8i's newly introduced unlimited-user license scheme may appear similar to DB2's pricing model on the surface. Indeed, it does simplify the process to a large degree, and supports an unlimited number of users under one license. However, Oracle8i has positioned its pricing so high that it exceeds the reach of many customers. More important, it is prohibitively expensive for start-up Internet companies, the very audience that this model supposedly targets. Unlimited-user pricing typically costs three to five times the price for minimum named users on any particular platform. The contrast with DB2 UDB is even more dramatic, with  DB2 UDB costing 15 to 30% of the equivalent Oracle8i price on many platforms.

When an Oracle8i system is configured for a minimum number of users running on 550 MHz processors or faster, DB2 UDB provides a moderate price benefit. As users are added to the system, DB2 UDB demonstrates far greater price advantages compared to Oracle8i, so that a DB2 UDB system often costs as little as one third the price of an equivalent Oracle8i system. For data warehouses, DB2 UDB provides a minimum price benefit of about 25% on both single-system and multi-system configurations, with additional savings as users are added.

In other words, DB2's pricing structure has a scalability advantage. When configuring a system to support a minimum number of users (defined by Oracle8i as 20 MHz per user), DB2 UDB list prices are often marginally higher than Oracle8i's. When configuring the same system to support a greater number of users, however, DB2 UDB offers considerable savings. Total software costs can be less than half of Oracle8i's. This consideration is extremely important to customers who must look not merely at the present but also down the road to potential costs as their businesses expand.

Furthermore, DB2 UDB adopts a straightforward, predictable, and moderate pricing model. Customers can upgrade their processors and add users without incurring additional licensing fees for their DBMS software. DB2 UDB users incur additional fees only when they add CPUs to their system.

Oracle8i customers, by contrast, encounter steep license fees as they add users and processing power. Furthermore, these fees are often difficult to calculate and to predict. Other details in the Oracle8i pricing policy can discourage customers from enhancing their existing systems with either traditional or new technologies.

Finally, there are special pricing alternatives that are available from both vendors. DB2 UDB customers interviewed for this study have stated time and again that IBM understands their business model and has engineered a payment plan that suits their budget and their expectations for current and future cash flow. This is particularly true for startup technology companies.

## A COMPARISON OF PRICING MODELS

Oracle8i and DB2 UDB base their pricing on very different models. DB2 UDB uses a straightforward per-processor model, providing an unlimited user license for Enterprise Edition (DB2 UDB EE) and Enterprise-Extended Edition (DB2 UDB EEE) licenses. Oracle8i's pricing strategy, by contrast, encompasses two models – an unlimited user model and a named-user model. Within each model, it factors in processor speed, number of processors, and number of systems (single-system vs. multi-system). As a result, customers find it difficult to estimate initial costs and even more difficult to estimate the cost of future expansion. Oracle8i's pricing strategy includes the following rules:

- Oracle8i charges steep license fees for unlimited-user licenses. These licenses cost three to five times the price of a DB2 UDB license, whether deploying for OLTP, data warehousing, Intranet, or Internet.

- Under its named user policy, Oracle8i does not distinguish between full-time users and occasionally connected users. Customers must pay full price even for users who log on just once or twice a week.

- Oracle8i enforces a minimum-user policy with respect to platforms, so that owners of powerful systems may pay for more users than actually exist. This rule becomes significant in two ways:

    - Data warehousing applications are often CPU-intensive though they typically have relatively few concurrent online users. In this case, the minimum named user provides more than enough licenses for the number of users who will actually use it.

    - System management and diagnostic software are charged according to the "minimum user" policy that is based on CPU power, even though just a few people use it.

- Oracle8i charges steep license fees for MPP warehousing systems, with list prices up to double those of DB2.

Because Oracle8i and DB2 UDB base their pricing on different models, this study examines several different scenarios and configurations to uncover the trends. For this reason, we are looking at several situations that highlight these differences.

Exhibits 1 through 7 demonstrate how these pricing policies work out when compared with DB2's pricing. The exhibits are based on the pricing schedules that appear in the appendix to this report.

*EXHIBIT 1:*
*Unlimited user*
*license charges for a*
*500 MHz system*
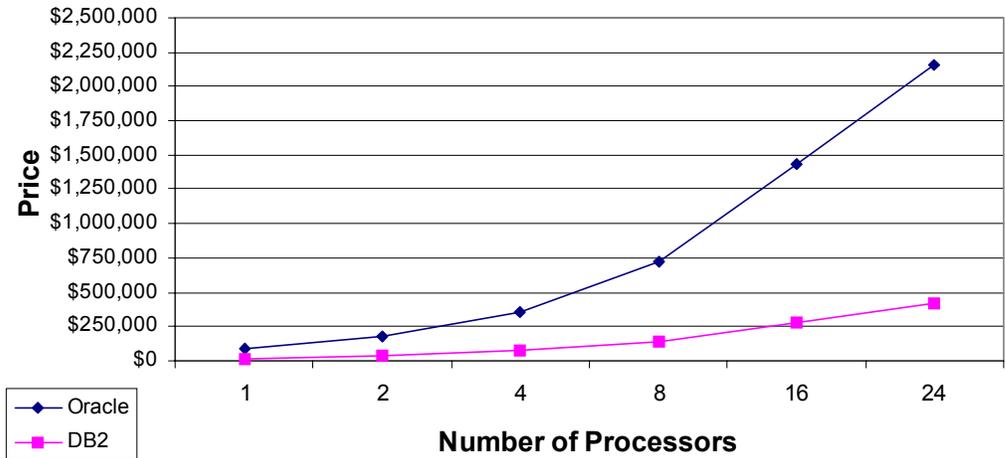


*EXHIBIT 2:*
*Unlimited user license*
*charges for a 500 MHz*
*system deployed for Internet*
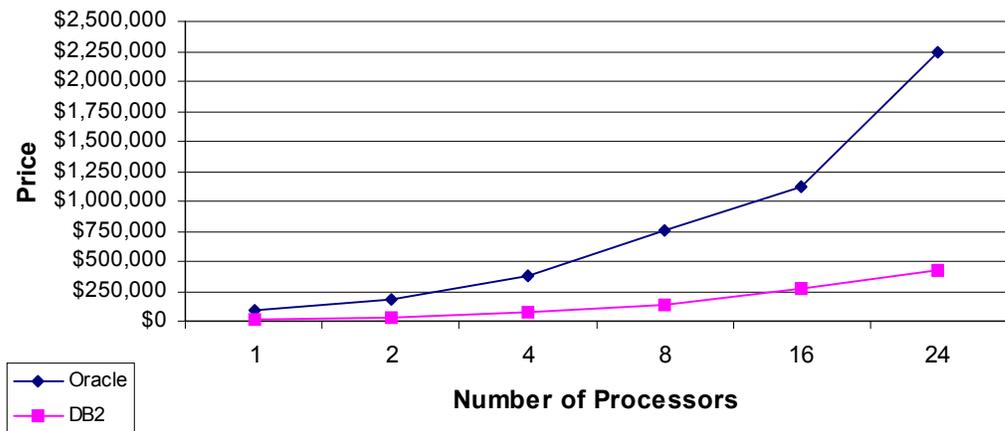


**1. Oracle8i's high cost unlimited-user licenses limit its practicality especially to internet environments where it is required.**

Exhibit 1 contrasts the price of unlimited-user licenses from IBM and from Oracle8i. Oracle8i's pricing is prohibitively high. Exhibit 2 compares the price of unlimited-user licenses in an Internet environment. Since Oracle8i has recently unbundled its webDB product (now called the Oracle8i Portal) from Oracle8i, the DBMS no longer has the intrinsic capability for web deployment. As a result,

the cost of IAS must be added to the base. This yields an entry-level price of $93,750. In this situation, DB2, bundling WebSphere Standard Edition with the DBMS, provides a whopping 81% price advantage for a 500 MHz system.

*EXHIBIT 3:*
*Oracle8i Pricing Models*

| Oracle8i Pricing Models | OLTP/ Standard | Data Warehouse | Intranet | Internet |
|---|---|---|---|---|
| **Named user single system** | yes | yes | yes | no |
| **Named user multi system** | yes | yes | yes | no |
| **Unlimited users (Universal Power Unit – UPU)** | yes | no | yes | yes |

Because of these pricing policies, customers will avoid Oracle8i's unlimited user licenses on UNIX/RISC systems, except for Internet applications. When they choose the unlimited user license, they will likely choose Intel-based systems such as Linux, since Intel licenses cost two-thirds that of RISC licenses.

Recognizing this fact, Oracle8i salespeople will present this option only for Internet applications, where it is required. Exhibit 3 summarizes the Oracle8i price models and their suitability to application types.

*EXHIBIT 4:*
*Minimum license charges*
*for 500 MHz system*
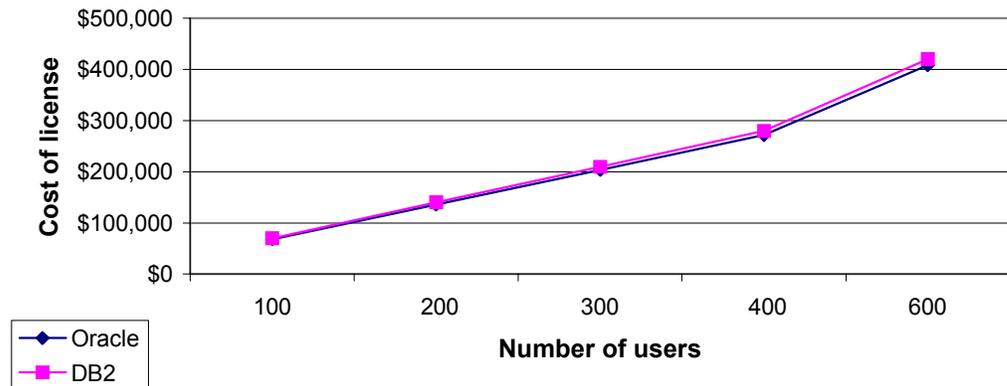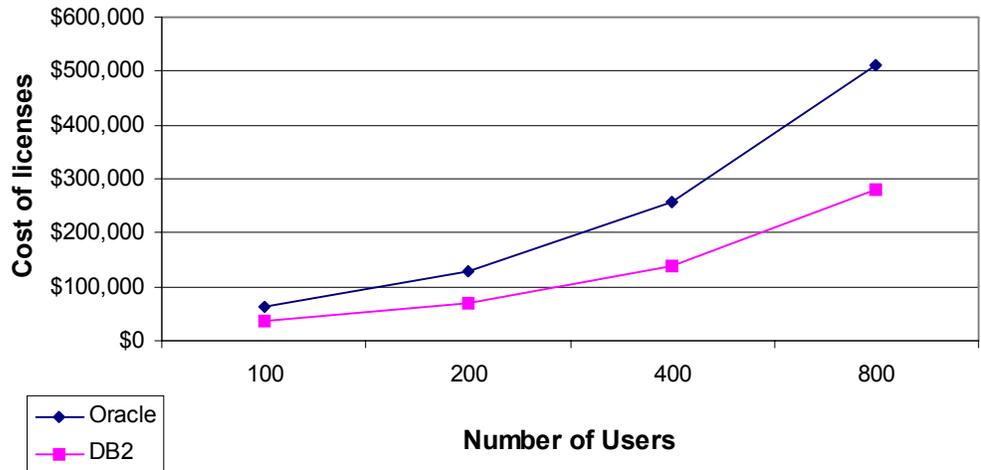
**2. DB2's per-processor pricing model makes it more economical for customers to add users to the system as their business grows. Oracle8i's named user licenses can cost over twice as much as IBM's.**

Exhibit 4 shows that when deployed on a single 500 MHz system, license charges for DB2 UDB and Oracle8i are virtually identical. DB2 UDB prices run about 3% higher than Oracle8i's. However, when the number of users installed on these systems is doubled, a considerable divergence occurs in pricing, as shown in Exhibit 5. Oracle8i licenses grow considerably more expensive as users are added to the system, whereas the IBM price rises more moderately. On a 500 MHz machine, for example, DB2 UDB costs 55% of an ever-increasing Oracle8i cost. DB2 UDB licensing is even more competitive on faster CPUs, costing only 46% of Oracle8i pricing on a 600 MHz machine.
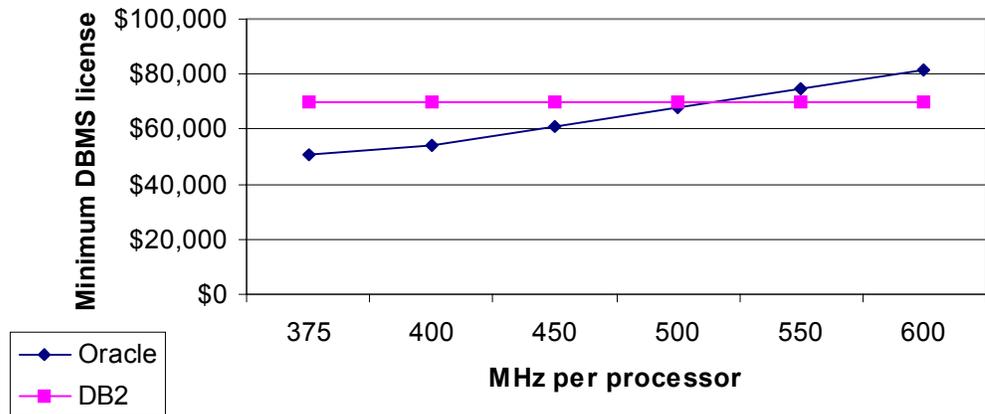
**3. Oracle8i's pricing encourages the use of slow processors.**

Oracle8i's pricing shows a bias towards slower processors. As seen in Exhibit 6, per-processor licensing charges vary based on the number of processors and how fast they run. The minimum price for faster processors is higher, even if the

installed base does not reach the minimum user level. IBM's per-processor pricing, by contrast, remains constant, so that the user can benefit from enhanced technology as it emerges. In fact, under IBM pricing, customers can upgrade their processors to support more users or to enhance performance without any change to their DBMS license fees. Oracle8i users cannot. Processor upgrades can incur additional DBMS license fees, even though the software has not been changed in any way.

*EXHIBIT 7:*
*License charges for 4x4*
*MPP data warehouse*



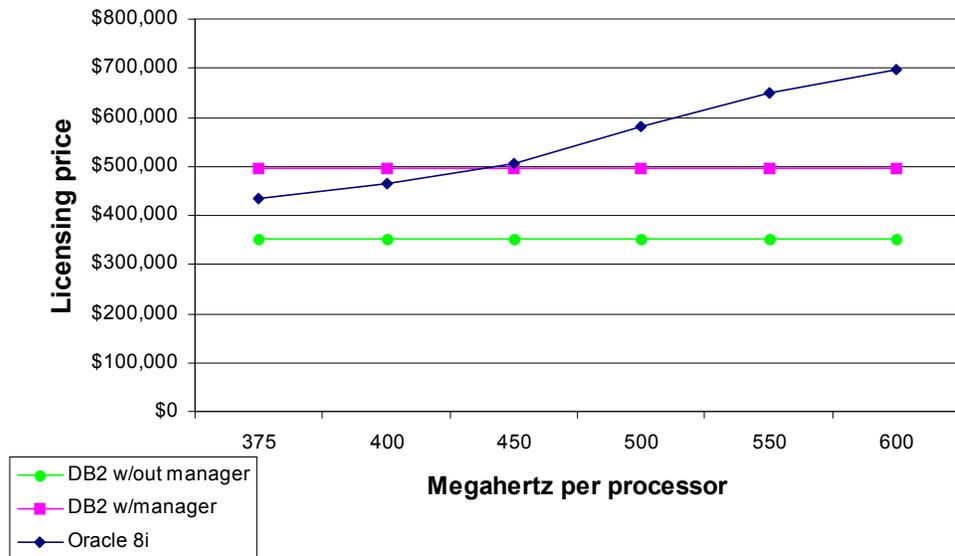**4. DB2 UDB saves the customer up to half the licensing price for a base-MPP data- warehousing function, and it saves the customer even more when adding optional software for all processors above 450 MHz.**

Exhibit 7 demonstrates that DB2 UDB EEE is more cost effective than Oracle8i's data warehousing solution for all processors 375 MHz and above. (Processors below 375 MHz were not evaluated in this study.) Furthermore, it demonstrates the economy of the DB2 UDB solution even when including the optional DB2 Warehouse Manager where DB2 UDB delivers a price advantage for all processors of 450 MHz or higher.

The DB2 Warehouse Manager provides the following capabilities, among others:

- Enables point-to-point data movement, bypassing an NT-based staging area.
- Enables end-user self-sufficiency through the information catalog and Query Patroller for greater DBA efficiency and end-user satisfaction.

While the DB2 Warehouse Manager is optional, DHBA considers the benefits to be highly desirable. For this reason, both options are included in this report.

Customers who do not need the DB2 Warehouse Manager can save up to 50% of the Oracle8i price for a 4x4 MPP system using 600 MHz processors, or

$350,000. Customers who purchase the optional DB2 Warehouse Manager will save up to 30% for all systems running at 450 MHz or higher, and will derive the added benefit of end-user empowerment.

**5. IBM's alternative plans for licensing and financing are more flexible and predictable than Oracle8i's.**

To support startup technology companies, Oracle8i offers two-year and four-year licenses at reasonable cost. There are two pitfalls to their approach, however, that dilute the attractiveness of these offerings:

- Customers must pay full price for service, substantially increasing the total price for the software.
- There is no price guarantee for licensing or upgrades beyond the specified period.

IBM's approach is flexible and customized. Each deal is negotiated separately, based on the individual customer's business model. IBM agrees to charge the customer as a proportion of the income received, typically 5% to 15% of customer income, depending on the strategic importance of the DBMS technology to the company. As revenues grow, IBM will charge more until the customer is paid up. In this way, IBM gives young companies the technology and the license arrangement that enable growth, and it shares in the business success of their customers.

# CHAPTER 3. SERVICES

*EXHIBIT 8:*
*Five-year cost of service*
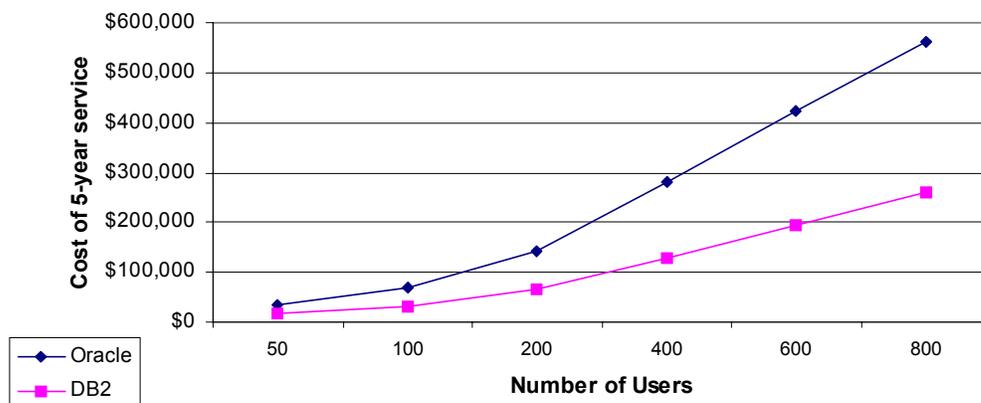


## SUMMARY

Though Oracle8i and DB2 UDB apply different formulas to price their services, the end result over five years is very similar. Five years of 24x7 service combined with upgrade subscription more than doubles the initial license cost for both DBMSs. Therefore, IBM's pricing structure for service reinforces the DB2 UDB pricing and scalability advantages established in its product pricing strategy (see Chapter 2). Furthermore, the IBM pricing policy for service shows attention to client concerns and respects the customer's right to freedom of choice. In addition, it offers a low-cost alternative for customers who prefer it.

## THE PRICE FOR SUPPORT

Oracle8i offers several layers of support. For the Enterprise Edition, it offers Product Support and Updates Subscription Service support. Oracle8i charges 7% and 15%, respectively, for these services.

DB2's support pricing is a bit more complex since it factors in the number of processors as well as the age of the license. Exhibit 9 summarizes the formulas for calculating support in all categories.

| Service | DB2 | Oracle8i | DB2 Notes | Oracle Notes |
|---|---|---|---|---|
| **No Service Purchased** | yes | no | Included in product price. | Owning Oracle8i without service is not viable, since you don't get fixes |
| **9x5** | yes | no | $500/processor/year | Oracle8i does not currently offer 9x5 protection. IBM is $500/processor/year |
| **24x7** | yes | yes | $500/processor/year + 2900/named advocate. We will assume 1 advocate/CPU | 5% of total price |
| **Upgrade subscription** | yes | yes | IBM=10% first year, 20% subsequent years | 17% of total price |

## PATCHES AND FIXES

A closer look at Oracle8i support policies deserves attention. Note that the Updates Subscription Service includes not only release upgrades but also maintenance upgrades and fixes. In other words, the Oracle8i customer does not receive patches and fixes without this level of support, so that the Updates Subscription Service is mandatory for just about every Oracle8i customer. This represents a veiled surcharge to the base price. To repeat, the Subscription Service is virtually mandatory, since it is required in order to receive patches. This surcharge puts DB2 UDB base prices ahead not only in the price of scalability, as demonstrated in Chapter 2, but in every category and every price point. Exhibit 10 summarizes the support policies in all categories.

| Policy | IBM | Oracle8i |
|---|---|---|
| Bug fixes | free | cost |
| Upgrade protection | cost | cost |
| Telephone support – "handholding" | cost | cost |

## OTHER

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 lie beyond the scope of this report.

# CHAPTER 4. PACKAGING VALUE ANALYSIS

## SUMMARY

IBM augments DB2's favorable pricing strategy with beneficial product and feature bundling, simplifying the decision-making and purchasing process and saving money for customers. Bundled features in DB2 UDB 7.1 save customers over $70,000 when configuring a four-way SMP RISC system running at 500 MHz with 100 users. Results can be considerably greater when configuring a larger system, greater number of users, or faster processors. Exhibit 11 summarizes the bundled features.

In the area of data warehousing/business intelligence, IBM's packaging saves the customer almost $35,000, widening by a considerable margin the price differential presented in Chapter 2. For a four-way SMP RISC system running at 500 MHz with 100 users and selecting the first three options in Exhibit 11, the DB2 UDB price is $104,000 whereas the Oracle8i price is over $150,000, almost half again the DB2 UDB price.

*EXHIBIT 11:*
*DB2 UDB vs. Oracle8I –*
*Bundled Features*

| Product/Capability | Oracle 8i | DB2 UDB |
|---|---|---|
| **Data extract & transformation wizard** | Charged separately | included |
| **Access to mainframe DB2** | Charged separately | included |
| **OLAP Starter Kit** | Charged separately | included |
| **Web server** | Charged separately | included |

### DATA EXTRACT AND TRANSFORMATION WIZARDS

DB2 UDB EE 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.

Oracle8i's Warehouse Builder delivers equivalent function as an extra-cost option. Note that IBM's Data Warehouse Manager, an optional component of IBM's data warehousing solution, was included in the base price for warehousing in the product pricing chapter, so that it is already factored into the total picture.

### ACCESS TO MAINFRAME DB2

DB2 UDB includes access to mainframe data using technology incorporated from DB2 Connect. Oracle8i's mainframe connectivity requires its Open Systems Gateways, with a hefty price tag.

**OLAP STARTER KIT**

DB2 UDB bundles a license for three users at no extra charge, with access to a subset of the analytical functions available on the full OLAP Server. An OLAP Starter Kit includes,

- License for three concurrent users.

- Spreadsheet add-ins.

- Multidimensional and relational storage managers.

- Integration Server: OLAP model desktop, OLAP meta-outline desktop, administration manager.

This capability will enable customers with moderate data warehousing/business intelligence requirements to benefit from the technology at modest cost. The package should be sufficient for installations that run a small number of pre-designed reports on a scheduled basis, with few analysts performing *ad hoc* queries. In installations where many active users run queries on an as-needed basis, the complete version of OLAP Server will probably be required.

**WEB SERVER**

DB2 UDB EE bundles the WebSphere Standard Edition. Oracle8i's Internet Application Server, by contrast, is an extra-cost option.
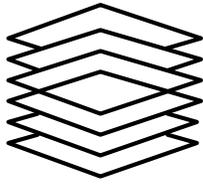
*PART II.*

*Efficiencies*

# CHAPTER 5. METHODOLOGY

*EXHIBIT 12:*
*DBA Activities, Weighted*
*by Application Type*

| Activities | OLTP % of Total Effort | Internet % of Total Effort | DW SS % of Total Effort | Large OLTP % of Total Effort |
|---|---|---|---|---|
| **Database Development Tasks** | | | | |
| Installation and update | 1 | 1 | 1 | 1 |
| Planning and modeling | 15 | 10 | 15 | 15 |
| Staff-related activities | 15 | 15 | 10 | 15 |
| Query optimizations | 10 | 20 | 10 | 10 |
| Data Movement | 0 | 10 | 10 | 0 |
| Change management | 15 | 15 | 5 | 15 |
| Distributed database | 0 | 0 | 5 | 0 |
| Application-specific details | 4 | 4 | 4 | 4 |
| **Routine Admin and Operation** | | | | |
| System monitoring and troubleshooting | 20 | 20 | 15 | 20 |
| Routine operations | 15 | 10 | 10 | 15 |
| Query governance | 0 | 5 | 10 | 0 |
| Staff-related activities | 5 | 5 | 5 | 5 |
| **Total** | 100 | 100 | 100 | 100 |

Part II of this report evaluates the time-saving characteristics of the DBA tools and facilities. To evaluate the impact of any single feature on total cost of ownership, it is necessary to estimate the actual time that is consumed by manual performance of the equivalent set of tasks. Individual projects can vary greatly from this model, depending on project size, complexity, existing information resources, expertise of personnel, etc. The actual benefit derived from these efficiencies varies from application to application and from environment to environment. For example, data movement might constitute up to 15% or more of the work 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. The estimates presented here and in the following chapters are extrapolated from DHBA interviews with users about a diverse group of projects.

The estimates used in this chapter are summarized in Exhibit 12 above. In this chart, the "Activities" column lists the major tasks in database development, administration and operation, calling out specific activities when they are particularly time-consuming and/or when the DBMS vendors have provided noteworthy automation. The columns marked "% of Total Effort" indicate the percent of total effort that is devoted to a particular task.

Note that the planning and modeling stages of development, consuming 10 to 15% of the total project time, are DBMS-independent. This expense is incurred irrespective of the DBMS used. Similarly, DBMS-independent staff-related activities – scheduling, briefing, synchronizing, training, etc. – consume an additional 10 to 15%. Of the remaining activities, query optimization (including indexes), data movement routines (for warehousing applications), and change management activities 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.

# CHAPTER 6. COST ANALYSIS: DATABASE DEVELOPMENT

*EXHIBIT 13:*
*DBA Efficiencies –*
*Database Development*

| Activities | DB2 UDB Efficiency (%) | Oracle8i Efficiency (%) |
|---|---|---|
| **Database Development Tasks** | | |
| Installation and update | 50 | included |
| Planning and modeling | 0 | 0 |
| Staff-related activities | 25 | included |
| Query optimizations | 50 | included |
| Data movement | included | 30 |
| Change management | included | 50 |
| Distributed database | 50 | included |
| Application-specific details | included | included |

Efficiencies shown are above a base level of automation that each product has in common.

## SUMMARY

While Oracle8i and DB2 UDB both provide a full range of tools to support the development, administration and operation effort, DB2 tools provide a greater level of automation, shielding the DBA from much technical complexity, and ultimately delivering greater efficiency. This reduces training costs, and total cost of ownership. Among development tasks, DB2 UDB delivers a 50% advantage in Installation and update, Query optimizations, and Distributed database. DB2 UDB delivers a 25% advantage in staff-related activities by reducing the effort of training and coordination. Oracle8i balances these efficiencies somewhat with a 50% streamlining of the Change management effort and 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 that are presented in the Methodology chapter. Chapter 8 of this report factors in the weighted efficiencies along with costs of software and service.

## INSTALLATION

Oracle8i is notoriously difficult to install. The Parallel Server (OPS) in particular requires many low-level operations that are error-prone. To install OPS, 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. Then it

must set an environmental variable to point to the ASCII mapping file. Following these steps, the DBA creates a UNIX account on each node, create a mount-point directory on each node, and then set up users and replicate to all nodes. Even for single-system installation, Oracle8i requires the DBA to set operating-system parameters by following a confusing and verbose set of instructions in the documentation.

DB2 UDB EEE, by 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 partitions 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. DHBA estimates that a DB2 UDB installation requires about one third the man-hours of an equivalent Oracle8i installation.

## PLANNING AND MODELING

On average planning and modeling consumes 10 to 15% of the total effort of database creation, administration, and operation,. However, these tasks are database-independent and are equivalent for both DBMSs.

## STAFF-RELATED ACTIVITIES

In the area of staff-related activities, DBAs attend meetings, coordinate and schedule tasks, receive and deliver training, and so on. 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 Oracle8i and guides the DBA through a sequence of steps. DHBA estimates that the DB2 UDB style can reduce staff-related activities by up to 25%.

## QUERY OPTIMIZATION

IBM's cost-based optimization is more mature than Oracle8i's in query optimization. As a result, IBM has a more complete set of optimization strategies and techniques. Its optimizations cover a broader range of special situations, including specific circumstances that will slow down a system. As a result, the DB2 UDB query or load operation can complete orders of magnitude faster - one hour instead of ten in certain instances. In terms of personnel cost savings, the more advanced optimizer can save the DBA hours of tuning, exploration, and re-design to discover an approach that can fit within the maintenance window. DHBA estimates that DB2's superior query optimizer cuts the total effort of query optimization in half.

## 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 designing the load process so that it completes the task within the maintenance window assigned to it. IBM offers a mature set of utilities for this purpose, and has a reputation for very fast loads. Its Data Warehouse Center provides a framework and GUI for defining and maintaining extract, load and transform (ETL) functions in the warehouse.

Oracle8i essentially matches these capabilities. It also offers a facility called Transportable Tablespaces that enables rapid direct export and import from one tablespace to another without the need to copy the column definitions manually, without the need for intermediate staging databases, and without the need to reconstruct indexes. At least in theory, this facility reduces the menial task of copying and the associated task of detailed verification that the load was completed successfully. 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 mainframe data 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, and are not suitable for the largest databases that must be transported within a defined time window.

DHBA estimates that Transportable Tablespaces addresses about 60% of data movement routines and saves about half of the development effort for the routines that use it. (Note that the applicable routines are simple to implement even under the older method, since they are essentially simple copy operations.) Based on this estimate, Oracle8i 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. Oracle8i automates the process of change management, relieving the DBA of most of this burden. DHBA estimates that Oracle8i's Change Management Utility reduces the amount of time dedicated to cleanup by half. Note that the change management feature is an extra cost item

that must be reckoned into the total cost of ownership (TCO), offsetting some of the productivity gain in the TCO picture. When deployed on a four-way 500 MHz RISC system with an unlimited user license, the Change Management Utility costs $3,000.

## DISTRIBUTED DATABASE

While both DBMSs claim to define an object-based environment for defining joins and links, DB2 UDB delivers a better architecture for defining the relationships among objects across multiple databases. DB2's vocabulary allows the DBA to create SERVERS, WRAPPERS, and FUNCTION MAPPINGS, and then to define the relationship among them. This architecture promotes re-use, eliminates redundancies, and streamlines the process of making changes. Oracle8i's CREATE DATABASE LINK syntax, by contrast, requires the DBA to create more links and is less conducive to re-usability. Furthermore, Oracle8i requires the DBA to create and maintain ASCII files for each link. DHBA estimates a 20% initial benefit 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, DHBA allocates 4% of the development effort to application-specific details that cannot be evaluated here.

# CHAPTER 7. COST ANALYSIS: ADMINISTRATION AND OPERATION

*EXHIBIT 14:*
*DBA Efficiencies –*
*Administration and Operation*

| Activities | DB2 UDB Efficiency (%) | Oracle8i Efficiency (%) |
|---|---|---|
| Tuning, monitoring, and troubleshooting | 15 | 5 |
| Routine operations | 10 | included |
| Query governance | 30 | NA |
| Staff-related activities | 20 | included |

Efficiencies shown are above a base level of automation that each product has in common.

## SUMMARY

DB2's 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.

The DB2 UDB 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 handled successfully by DBAs with lesser training. As shown in Exhibit 14, DHBA estimates a 15% advantage in performance-related activities, 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. Oracle8i, in turn, provides a 5% 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 Chapter 5, which covers Methodology. Chapter 8 of this report factors in the weighted efficiencies along with costs of software and service.

## SYSTEM MONITORING AND TROUBLESHOOTING

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

situation. Both Oracle8i and DB2 UDB 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, runstats to refresh the optimizer, and so on. Oracle8i's diagnostic and performance tuning options provide advanced editors, with sorting and filtering options, for performing these tasks in an elegant environment. DHBA estimates that these interfaces improve DBA efficiency in monitoring, tuning, and troubleshooting by 5%.

The IBM GUI interface often presents a goal-oriented choice to the DBA, whereas Oracle8i might in the same situation present the DBA with a list of parameters to edit. For example, DB2 UDB prompts the DBA to choose between maintenance-oriented space management and performance-oriented space management. On the same screen, DB2 UDB explains the action in technical terms, so that the experienced DBA gets a precise definition. Oracle8i DBAs do not receive this level of support. Instead of specifying goals, they must design these features at a more technical level. DHBA estimates a 5% advantage in system monitoring and troubleshooting.

## ROUTINE OPERATIONS

In the area of 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 jobs 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 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, nevertheless, the Query Patroller enables the end user to self-manage in a large number of cases.

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 manner, suitable for end users. Query Patroller reduces the number of individual requests by an estimated 30%.
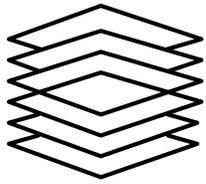
*PART III.*

# Scenarios

# CHAPTER 8. SCENARIOS

## SUMMARY

In Part II of this report, we highlighted specific efficiencies that differentiate Oracle8i from DB2. In this chapter, we will evaluate the impact of these efficiencies on the total cost of ownership over a five-year period. We will evaluate their impact in four different scenarios: four-way OLTP, 64-way OLTP, Internet, and data warehousing. Work-effort calculations are based on the following conclusions, derived from combining the data in chapters 5, 6, and 7: DB2 UDB efficiencies yield an overall reduction in the work effort of 6% for OLTP systems, 15% for large OLTP systems, 20% in Internet-enabled databases, and 18% for data-warehousing systems.

## OLTP

*EXHIBIT 15: OLTP Scenario*
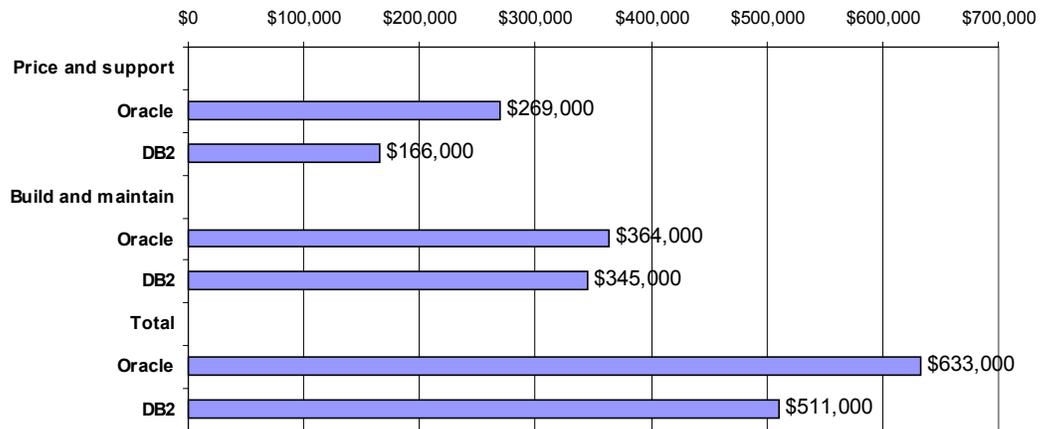


The DBMS of a hypothetical OLTP system will reside on a four-way, 500 MHz RISC system with 50 GB of disk space, 200 users, service contracts for software upgrades and 8x5 coverage. The work effort for database creation is estimated to be a 13-week project to be built in-house by one DBA earning $104,000 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 $78,000, supervised by a $104,000 DBA who devotes 20% of work-time to the project.

In this scenario, DB2 UDB holds a cost advantage in all of the expense categories evaluated – software, services, development, and maintenance. DB2 UDB software and services cost only 62% of Oracle8i's, the greatest source of savings. This strong price advantage is diluted somewhat since software and service constitute less than half of the total expense for the project, where DB2 UDB retains a more modest lead of 5 to 7%. Overall, for this OLTP scenario, total expenses for the DBMS over five years total only 81% of the same project implemented with Oracle8i.

## LARGE OLTP

*EXHIBIT 16:*
*Large OLTP Scenario*
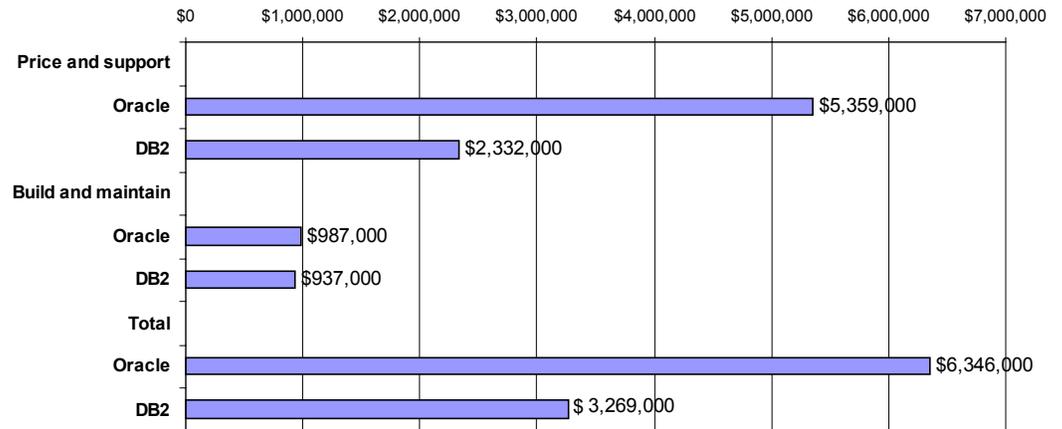


The DBMS of a hypothetical large OLTP system will reside on a 64-way 600 MHz RISC system with 2 TB of disk space, 3 million transactions per day, 2,200 users, service contracts for software upgrades and 24x7 coverage. The work effort for database creation is estimated to be a 26-week project to be built 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 holds a cost advantage in all of the expense categories evaluated – software, services, development, and maintenance. DB2 UDB software and services cost only 44% of Oracle8i's, and represent the greatest source of savings. 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 expenses over five years cost only 52% of the same project implemented with Oracle8i.

# DATA WAREHOUSING

| | | |
|---|---|---|
| **Price and support** | | |
| Oracle | $2,217,600 | |
| DB2 | $1,025,900 | |
| **Build and maintain** | | |
| Oracle | $3,421,912 | |
| DB2 | $3,208,959 | |
| **Total** | | |
| Oracle | $5,639,512 | |
| DB2 | $4,234,859 | |
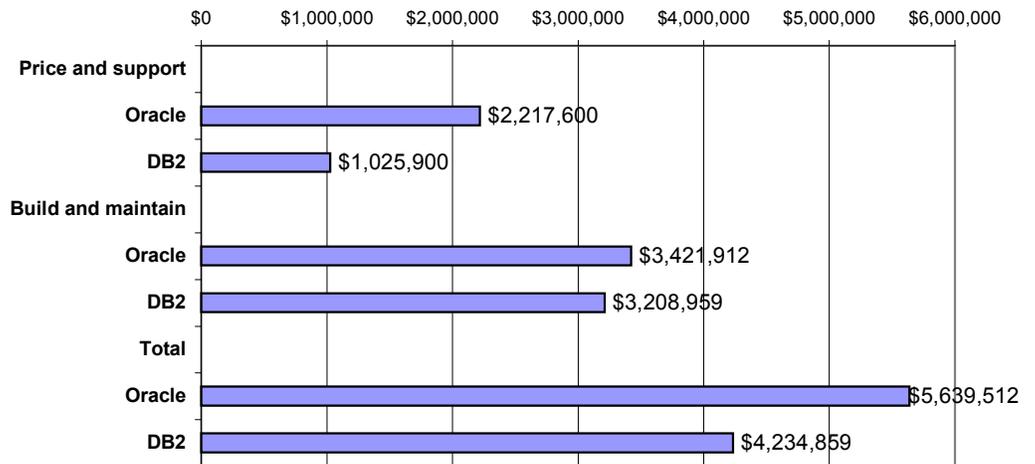
The DBMS of a hypothetical data warehousing system will reside on a four-node four-way 600 MHz RISC system with 50 GB of disk space, 50 users, service contracts for software upgrades and 24x7 coverage. The work effort for database creation is estimated to be a 52-week project to be built in-house by 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.

In this scenario, DB2 UDB holds a cost advantage in all of the expense categories evaluated – software, services, development, and maintenance. DB2 UDB software and services cost only 46% of Oracle8i's, and represent the greatest source of savings. In spite of the large cost of personnel, where DB2 UDB provides a 5 to 8% savings by virtue of its efficiencies, total DB2 UDB expenses over five years cost only 75% of the same project implemented with Oracle8i.

# INTERNET

*EXHIBIT 18:*
*Internet Scenario*

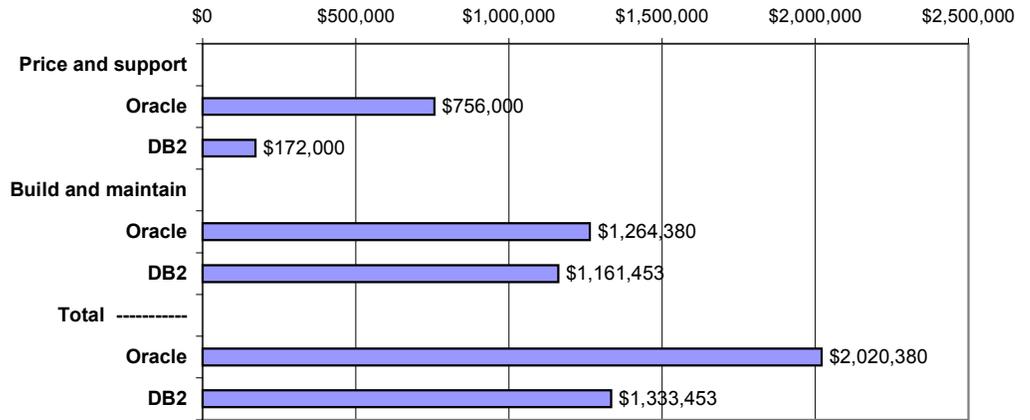| | |
|---|---|
| **Price and support** | |
| Oracle | $756,000 |
| DB2 | $172,000 |
| **Build and maintain** | |
| Oracle | $1,264,380 |
| DB2 | $1,161,453 |
| **Total** ----------- | |
| Oracle | $2,020,380 |
| DB2 | $1,333,453 |

The DBMS of a hypothetical web-enabled database system will reside on a four-way 500 MHz RISC system with 50 GB of disk space, 50 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 holds a cost advantage in all of the expense categories evaluated – software, services, development, and maintenance. DB2 UDB software and services cost only 23% of Oracle8i's, the greatest source of savings. In spite of the large cost of personnel, where DB2 UDB provides a 5 to 8% savings by virtue of its efficiencies, total DB2 UDB expenses over five years cost only 66% of the same project implemented with Oracle8i.
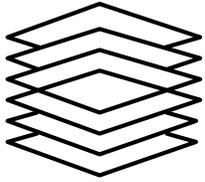
*APPENDIX.*
# Pricing Schedules[1]

*PRICING SCHEDULE 1:*
*DB2 and Oracle8i License*
*Charges – unlimited users*
*(Universal Power Unit)*

| CPUs | DB2 All Speeds | Oracle8i 375 MHz | Oracle8i 400 MHz | Oracle8i 450 MHz | Oracle8i 500 MHz | Oracle8i 550 MHz | Oracle8i 600 MHz |
|------|------|------|------|------|------|------|------|
| 1 | $17,500 | $67,500 | $72,000 | $81,000 | $90,000 | $99,000 | $108,000 |
| 2 | 35,000 | 135,000 | 144,000 | 162,000 | 180,000 | 198,000 | 216,000 |
| 4 | 70,000 | 270,000 | 288,000 | 324,000 | 360,000 | 396,000 | 432,000 |
| 8 | 140,000 | 540,000 | 576,000 | 648,000 | 720,000 | 792,000 | 864,000 |
| 12 | 210,000 | 810,000 | 864,000 | 972,000 | 1,080,000 | 1,188,000 | 1,296,000 |
| 16 | 280,000 | 1,080,000 | 1,152,000 | 1,296,000 | 1,440,000 | 1,584,000 | 1,728,000 |
| 24 | 420,000 | 1,620,000 | 1,728,000 | 1,944,000 | 2,160,000 | 2,376,000 | 2,592,000 |

**Notes:**

- To calculate the number of Universal Power Units (UPUs), multiply the number of CPUs by the number of megahertz * 1.5 for RISC systems..

- Price = UPU * ($100 for Oracle8i Enterprise Edition + $10 for Diagnostic Pack + $10 for Tuning Management Pack)

*PRICING SCHEDULE 2:*
*Oracle License Charges –*
*Unlimited users: Oracle8i*
*plus Internet Application*
*Server (IAS)*

| CPUs | 375 MHz | 400 MHz | 450 MHz | 500 MHz | 550 MHz | 600 MHz |
|------|------|------|------|------|------|------|
| 1 | $70,313 | $75,000 | $84,375 | $93,750 | $103,125 | $112,500 |
| 2 | 140,625 | 150,000 | 168,750 | 187,500 | 206,250 | 225,000 |
| 4 | 281,250 | 300,000 | 337,500 | 375,000 | 412,500 | 450,000 |
| 8 | 562,500 | 600,000 | 675,000 | 750,000 | 825,000 | 900,000 |
| 12 | 843,750 | 900,000 | 1,012,500 | 1,125,000 | 1,237,500 | 1,350,000 |
| 16 | 1,125,000 | 1,200,000 | 1,350,000 | 1,500,000 | 1,650,000 | 1,800,000 |
| 24 | 1,687,500 | 1,800,000 | 2,025,000 | 2,250,000 | 2,475,000 | 2,700,000 |

**Notes:**

- Internet Application Server Standard Edition is priced at $5 per UPU.

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[1] Prices are current as of September 2000 and are subject to change without notice.

|  | 375 MHz | | 450 MHz | | 500 MHz | | 550 MHz | | 600 MHz | |
|---|---|---|---|---|---|---|---|---|---|---|
| CPUs | Users | Price | Users | Price | Users | Price | Users | Price | Users | Price |
| 1 | 19 | $12,920 | 23 | $15,640 | 25 | $17,000 | 28 | $19,040 | 30 | $20,400 |
| 2 | 38 | 25,840 | 45 | 30,600 | 50 | 34,000 | 55 | 37,400 | 60 | 40,800 |
| 4 | 75 | 51,000 | 90 | 61,200 | 100 | 68,000 | 110 | 74,800 | 120 | 81,600 |
| 8 | 150 | 102,000 | 180 | 122,400 | 200 | 136,000 | 220 | 149,600 | 240 | 163,200 |
| 12 | 225 | 149,600 | 270 | 187,000 | 300 | 204,000 | 330 | 224,400 | 360 | 244,800 |
| 16 | 300 | 204,000 | 360 | 238,000 | 400 | 272,000 | 440 | 304,640 | 480 | 326,400 |
| 24 | 450 | 299,200 | 540 | 357,000 | 600 | 408,000 | 660 | 456,960 | 720 | 489,600 |

*PRICING SCHEDULE 3:*
*Oracle8i License Charges –*
*single system, minimum users*

**Notes:**

- All pricing schedules are for RISC-UNIX systems. Oracle8i charges one third less for Intel-based systems.

- Oracle8i calculates minimum users per system at 20MHz/user.

- Oracle8i license for minimum users is $600 for Enterprise Edition + $40 for Diagnostics +$40 for Tuning.

- DB2 UDB license is $17,500 per processor.

|  | 375 MHz | | 400 MHz | | 500 MHz | | 550 MHz | | 600 MHz | |
|---|---|---|---|---|---|---|---|---|---|---|
| CPUs | Users | Price | Users | Price | Users | Price | Users | Price | Users | Price |
| 1 | 38 | $24,320 | 40 | $25,600 | 50 | $32,000 | 56 | $35,840 | 60 | $38,400 |
| 2 | 76 | 48,640 | 80 | 51,200 | 100 | 64,000 | 110 | 70,400 | 120 | 76,800 |
| 4 | 150 | 96,000 | 160 | 102,400 | 200 | 128,000 | 220 | 140,800 | 240 | 153,600 |
| 8 | 300 | 192,000 | 320 | 204,800 | 400 | 256,000 | 440 | 281,600 | 480 | 307,200 |
| 12 | 440 | 281,600 | 480 | 307,200 | 600 | 384,000 | 660 | 422,400 | 720 | 460,800 |
| 16 | 600 | 384,000 | 640 | 409,600 | 800 | 512,000 | 896 | 573,440 | 960 | 614,400 |
| 24 | 880 | 563,200 | 960 | 614,400 | 1,200 | 768,000 | 1,344 | 860,160 | 1,440 | 921,600 |

*PRICING SCHEDULE 4:*
*Oracle8i License Charges –*
*single system, double the*
*minimum users*

**Notes**

- User licenses beyond the minimum cost $600 per user: the customer need not pay beyond the minimum number of named users for the diagnosis and tuning software. Since the minimum named users for any particular system generally exceeds the number of administrators for that system, customers can safely purchase diagnostics and tuning licenses at the minimum user level. Assume, for example, that a four-way 500 MHz system is administered by three DBAs. The customer pays for the minimum named users for the diagnostic and tuning software – 100 users. When more than 100 users are named for the system, the customer must pay for the Oracle8i license – $600 per user – but need not purchase additional licenses for the diagnostic and tuning software, since these users will not be accessing that software directly.

| CPUs | 375 MHz | | 400 MHz | | 500 MHz | | 550 MHz | | 600 MHz | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Users | Cost | Users | Cost | Users | Cost | Users | Cost | Users | Cost |
| 1 | 19 | $27,550 | 20 | $29,000 | 25 | $36,250 | 28 | $40,600 | 30 | $43,500 |
| 2 | 38 | 55,100 | 40 | 58,000 | 50 | 72,500 | 55 | 79,750 | 60 | 87,000 |
| 4 | 75 | 108,750 | 80 | 116,000 | 100 | 145,000 | 110 | 159,500 | 120 | 174,000 |
| 8 | 150 | 217,500 | 160 | 232,000 | 200 | 290,000 | 220 | 319,000 | 240 | 348,000 |
| 12 | 220 | 319,000 | 240 | 348,000 | 300 | 435,000 | 330 | 478,500 | 360 | 522,000 |
| 16 | 300 | 435,000 | 320 | 464,000 | 400 | 580,000 | 448 | 649,600 | 480 | 696,000 |
| 24 | 440 | 638,000 | 480 | 696,000 | 600 | 870,000 | 672 | 974,400 | 720 | 1,044,000 |
| 32 | 600 | 870,000 | 640 | 928,000 | 800 | 1,160,000 | 896 | 1,299,200 | 960 | 1,392,000 |
| 36 | 680 | 986,000 | 720 | 1,044,000 | 900 | 1,305,000 | 990 | 1,435,500 | 1080 | 1,566,000 |
| 64 | 1200 | 1,740,000 | 1280 | 1,856,000 | 1600 | 2,320,000 | 1792 | 2,598,400 | 1920 | 2,784,000 |
| 96 | 1800 | 2,610,000 | 1920 | 2,784,000 | 2400 | 3,480,000 | 2688 | 3,897,600 | 2880 | 4,176,000 |

*PRICING SCHEDULE 5:*
*Oracle8i License Charges –*
*data warehouse*

**Notes**

- Oracle8i license for a multi-system data warehouse is $1,450 per user: $850 for Enterprise Edition, $300 for Parallel Server, and $300 for Partitioning.

- DB2 UDB license for Extended-Enterprise Edition is $22,500 per processor.

- DB2 UDB license for Extended-Enterprise Edition with the DB2 Warehouse Manager is $31,000 per processor: $22,500 for DB2 UDB plus $8,500 for the data warehousing software.