

Cost Comparison for Business Decision- makers

**Oracle Exadata Database Machine
vs. IBM Power Systems**

How to Weigh a Purchase Decision

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The New York Times recently described the problem of inefficiency in IT operations:

“It can take up to six months, research shows, to get a new business application up and running, from buying the hardware to fine-tuning the software. An estimated 70% of corporate technology budgets is spent on installing, updating and maintaining current technology... Although the problem has been developing for a long time, technology managers and analysts agree it is growing worse.”

—New York Times, April 10, 2012

“It may not be possible at all to match the performance of Exadata regardless of how many P7s you put in. But certainly you would need to have more CPUs on a standard platform to even come close to what you get from Exadata.”

– Kerry Osborne,
Co-founder, Enkitec,
Oracle specialist

To shorten the time required to bring software applications into production, IT vendors are beginning to move from traditional build your own (BYO) solutions towards more integrated alternatives that consist of business software applications pre-installed on dedicated hardware. Proponents claim this integration will reduce IT costs for deployment, operations and maintenance as well as speed the time to value by making the technology available more quickly to business users.

This new class of solutions, purportedly easier to purchase, implement, operate and support versus traditional BYO solutions, have been introduced by a number of IT vendors; however, little evidence has been produced to support these assertions.

Comparing the total cost of ownership of these packaged solutions is difficult because no single individual has an overview of costs. That’s because integrated solutions consolidate and streamline IT functions that are traditionally distributed across enterprise IT silos (e.g. hardware, operating system, storage, networking, database, applications, etc.)

Several approaches are currently being proposed, some use “packaged” or “bundled” solutions, some “appliances,” but Oracle’s “engineered system” approach stands out as it maintains data compatibility with extreme performance optimization from deep hardware and software integration. Oracle’s engineered systems comprise one of the most mature and successful offerings of integrated systems. Since acquiring hardware vendor Sun Microsystems, Oracle controls both hardware and the software similar to how Apple controls both the hardware and software for iPhone and iPad, thus positioning it to engineer greater value into the combination.

In this research-based white paper conducted at the request of Oracle, The FactPoint Group compares the cost of ownership of the Oracle Exadata

engineered system¹ to a traditional build-your-own (BYO) solution, in this case an IBM Power 770 (P770) with SAN storage. The IBM P770 was chosen given it is IBM's current most popular model, based on FactPoint primary and secondary research and IBM claims, and because at least one of the interviewed customers had specifically migrated from a P770 to Exadata, affording us a more specific data point for comparison. (See Appendix B for details about the configurations we compared)

This research found that Oracle Exadata:

- **Can be deployed more quickly and easily** requiring 59% fewer man-hours than a traditional IBM Power Systems solution.
- **Delivers dramatically higher performance** typically up to 12X improvement, as described by customers, over their prior solution.
- **Requires 40% fewer systems administrator hours to maintain and operate annually, including quicker support calls because of less finger-pointing and faster service with a single vendor.**
- **Will become even easier to operate over time** as users become more proficient and organize around the benefits of integrated infrastructure.
- **Supplies a highly available, highly scalable and robust solution** that results in reserve capacity that make Exadata easier for IT to operate because IT administrators can manage proactively, not reactively. Overall, Exadata operations and maintenance keep IT administrators from “living on the edge.” And it's pre-engineered for long-term growth.

Finally, compared to IBM Power Systems hardware, Exadata is a bargain from a total cost of ownership perspective: **Over three years, the IBM hardware running Oracle Database cost 31% more in TCO than Exadata.**

This whitepaper is designed as a tool for IT management to ascertain whether engineered systems offer sufficient price to value benefits for consideration.

¹ Just prior to publication of this study Oracle announced a new X3 version of Exadata in early October. It will supersede the X2 version that is used by the Exadata customers who participated in this study. The X3 version of the half-rack X2 version used in FactPoint's analysis will now have 64 cores (versus 48 in X2) and use the new higher performing, higher capacity flash technology. However, the pricing for X3 remains the same as X2 despite the increased capabilities. As a result, FactPoint anticipates the TCO and benefits of Exadata would exceed what is presented in this paper.

Between January and June 2012, the FactPoint Group conducted in-depth phone interviews lasting between one to three hours each with five Oracle Database Exadata customers and five IBM Power Systems customers, each running the Oracle Database Enterprise Edition. FactPoint interviewed IT executives with hands-on experience with Exadata and with IT departments running Oracle's database on IBM's Power Systems hardware. To fully assess all the acquisition and ownership costs, FactPoint conducted numerous interviews across multiple IT silos within users to capture and assemble a "big picture" view that covered purchasing, implementing, operating, and maintaining these systems. The research also captured qualitative "*voice of the customer*" information about their experiences, business benefits and overall analysis of their database system.

To elicit authentic responses from participants, FactPoint waited until the end of the interview to reveal Oracle as the research sponsor. All participants were offered anonymity and are described in this white paper only by their industry, application and/or job title. FactPoint identified nine interviews; research sponsor Oracle pointed to one. Two customers had experience with both Oracle Exadata and IBM Power Systems.

In addition to interviews (with up to four follow-ups)—primarily with database administrators (DBAs), system administrators and technical managers based on their hands-on experience purchasing, implementing, operating and maintaining these solutions—FactPoint researched pricing and licensing policies for both IBM and Oracle.

FactPoint also utilized Kerry Osborne, CTO at IT consulting firm Enkitec (based in Dallas, Texas) as a subject matter expert who participated in interviews, analysis of the data and conclusions of this report. Osborne is the co-author of *Expert Oracle Exadata*, the first book on how Exadata actually works. His firm has handled more than 80 Exadata implementations for customers as of August 2012.

More broadly, this research evaluates the impact of this new class of engineered solutions and compares the benefits to IT departments using a traditional set-up.

The research produced both a TCO model comparing costs of the two options and, separately, user quotes about other business benefits. Based on the customer interviews and input from subject matter experts, the Total Cost of Ownership (TCO) model includes:

- **Acquisition costs**
- **Implementation and Deployment costs**
- **Operations and maintenance (O&M) costs for three years**

In addition, the research identified business benefits from using Exadata that are unique to each customer and therefore challenging to represent in a generalized TCO model. Most resulted from two Exadata features: Faster deployment and performance improvements. These benefits are presented outside the TCO model, largely as quotes from participants. *Additional details about the research, the TCO model, and the configurations that were compared are presented in the Appendix.*

As the table below shows, participants were generally of comparable size (\$500 million to \$4 billion in revenue), industry, and size of database, 1-27 terabytes.

PARTICIPANT PROFILES

	Oracle Exadata Customers	IBM Power Systems Customers
Industries	Energy, Marketing, Logistics, Business Services, and Financial Services	Retail, Logistics, Business Services, Government, and Telecom
Revenues	Range: 500M–\$3 Billion Average: \$1.3 Billion	Range: \$1–\$4 Billion Average: \$2.1 Billion
Hardware	Exadata: 3 - Quarter-Rack 2 - Half-Rack Storage: Included	3 - P6, 2 - P7 Storage: 2 - NAS (NetApp), 3 - SAN (IBM, EMC)
Software	5 - Oracle Database Enterprise Edition 4 of 5 used RAC	5 - Oracle Database Enterprise Edition for AIX None used RAC
Database Size	Range: 1–20 TB Average: 6 TB	Range: 3–27 TB Average: 10 TB

Exadata can be implemented more quickly and easily than a traditional IBM Power Systems solution

"With Exadata, there is no software customization; it's Oracle out of the box. Exadata hardware and software implementation took one week. The alternative would have been a 10-month implementation."

-VP of Technology Infrastructure at Marketing Data Processor

The interviews with both Oracle and IBM customers substantiated that Exadata is easily implemented and deployed, largely because hardware and database software are delivered in a single, tightly integrated unit. All five Exadata interviews mentioned Exadata's easy deployment, typically implementing Exadata in a week: *"Basically it involved one person for three business days,"* said the VP of Technology Infrastructure at a marketing services company. Exadata's speed of deployments results in part from the more standardized and simplified way Exadata is installed.

Implementation costs and timelines were a huge driver for this outsourced marketing data processor. *"All other solutions that were considered would have required a huge amount of changes to our applications and processes,"* said the VP of Technology Infrastructure at this outsourcer, whose business model depends on billable hours to its clients, and deploying new technology is not billable.

At another outsourcer, the manager of database administration and data warehousing for a business services company echoed the same sentiments: *"We were able to take all our production loads and move them over. We were able to take all of our production code, tweak it very little and move it into the Exadata environment. We basically ported all our ETL and application code to Exadata."*

At an energy company, its manager of the database team described its Exadata implementation process: *"Oracle sent us a spreadsheet that showed us everything we need to get Exadata stood up--a lot of IP addresses, DNS names for nodes, and several ranges of IP addresses. They generated a script that we could run on a machine in our environment. That made the actual installation of the box in our environment very smooth. Everything was well oiled."*

Implementation costs

Implementation includes hardware and operating system installation, networking, configuration, database installation and initial performance tuning. However, this TCO calculation excludes database migration, testing or installing applications, which the research found variable among customers and independent of which hardware they utilized.

The research revealed that although the **average Exadata implementation takes just 59% fewer man-hours than a traditional IBM Power System**, the costs are

similar. The reason: Exadata participants used professional services from either Oracle (at \$255/hour) or an Oracle partner (at \$190/hour), while all IBM participants used in-house labor (\$79/hour was used for both IBM and Oracle).²

COMPARISON OF IMPLEMENTATION COSTS

See Appendix B for details about the configurations we compared

	Oracle Exadata	IBM P770
Labor*	49.4 man-hours	120.4 man-hours
Average Labor Cost*	\$10,461 All Exadata participants had used either Oracle (@\$255/hr) or an Oracle partner (@\$190/hr) for implementation	\$10,603 All IBM participants had used in-house labor (@\$79/hr) for implementation

*Labor does not include database migration or testing, which are similar and highly variable.

To compare implementation costs, FactPoint relied on time and labor figures from the interviews, rather than actual costs, because many enterprises by policy do not discuss IT costs.

As the timeline comparison in the next section illustrates, the elapsed time in a deployment can have a significant impact on how quickly business benefits are realized. Exadata's faster implementation means business initiatives dependent on the new database system can be launched sooner.

Rapid deployment in one dramatic case translated into retaining an important customer: *"If we didn't deliver on time we would have lost a major customer,"* said the head of infrastructure and network delivery for a financial services firm that switched from IBM to Exadata. *"The impact would have been severe."*

² These hourly rates were informed by the research and are typical for the US market. The same labor rate assumptions were used for both Oracle and IBM.

***A tale of two deployments:
Oracle Exadata versus IBM Power Systems***

In comparing implementation and total elapsed time first for an Exadata deployment and then for a comparable Oracle database on IBM Power Systems, note that the endpoint FactPoint chose for each deployment comes when the new Oracle database is ready to receive data.

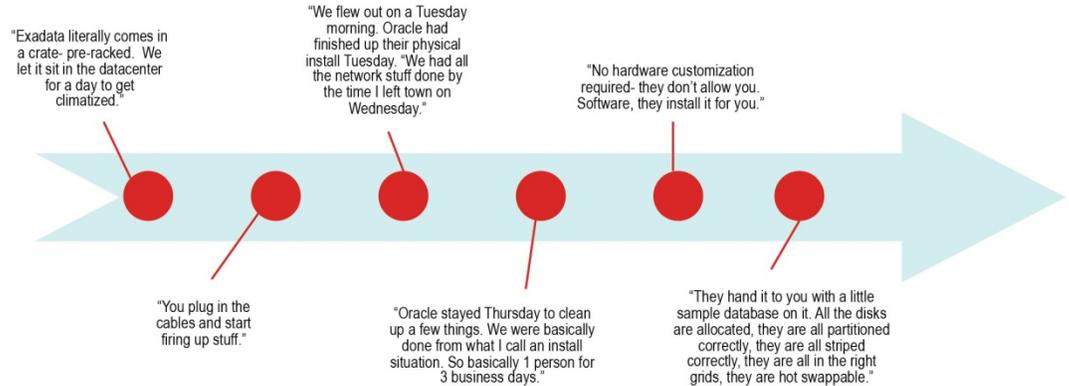
The elapsed time to put either Oracle Exadata or IBM Power Systems into production with live data can be far longer than man-hours to implement, often stretching deployments to 4-12 months, for several reasons:

- **General delays:** Because IT is extremely cautious, tasks often take longer than estimated.
- **Organizational delays:** Because they require cooperation (and thus scheduling with) other departments, finding a maintenance window or scheduling testing can produce substantial delays.
- **Organizational structures:** Most IT groups handle both implementation and operations, and operations always command higher priority than implementation. When operations problems need attention, the implementation timetable suffers.

For the marketing services company running Exadata, the initial deployment took a week, and that rapid roll-out was achieved in significant part because Exadata's pre-integrated elements of hardware, storage, networking and database software eliminate time spent installing them separately. **Quicker time to value is a benefit that all the Exadata customers mentioned regarding the solution.**

CASE STUDY

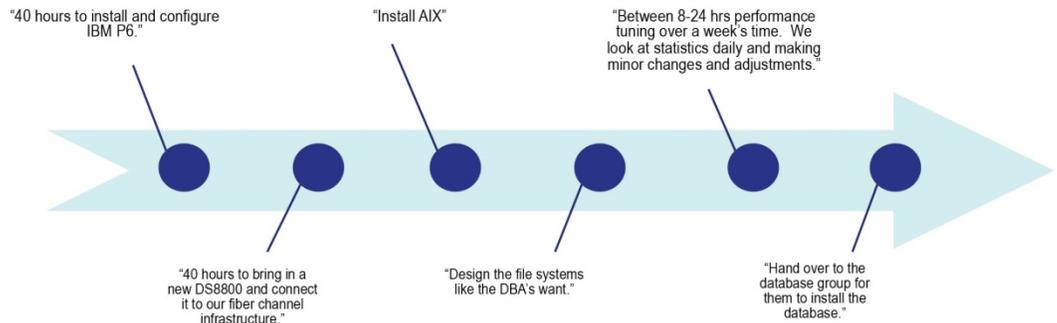
Marketing Services Company Implements Exadata in One Week



CASE STUDY:

Business Service Company Implements IBM Power Systems in Three Weeks

The timeline (below) for the IBM Power Systems is based primarily on a business services company, but it also draws from descriptions of multiple IBM Power Systems customers.



The IBM Power Systems deployment has more moving parts, because few if any components arrive even partially integrated. Before the hardware is delivered, the

IBM client can spend weeks in conceptual, logical and design phases. Once the IBM Power Systems box arrives, it needs to be installed, then the OS loaded, and then configured. Next the storage, in this case a new DS8800 storage unit, must be installed and cabled to the fiber channel network infrastructure.

However, four of five IBM customers reported deploying the IBM hardware with their own IT staff rather than using outside consultants. Based on other interviews, however, the three weeks it took this business services firm to install its IBM hardware in other cases stretched out to 4-6 months to reach production.

Oracle expert Kerry Osborne summarized the differences between the two timelines:

“With Exadata implementation, once the initial setup is done, which is about two or three days, you are good to go. Beyond that point there is not much difference from IBM P6 or P7. Migrating data is migrating data. Testing your app on [either set-up] is testing your app on it. Exadata gives you a 3-4 week head start over a P7.”

Exadata delivers higher performance over prior solutions, including IBM Power Systems

Even though our TCO comparisons included similar CPU core counts for a P770 and Exadata configuration, it was clear from customer experience that Exadata’s tight integration of hardware and software allows for pre-tuning for higher database performance³ without a customer spending staff time on tinkering with the system. Some Exadata customers were so impressed with its initial “out of the box” performance that they did not spend additional time on tuning.

“If you’ve migrated to Exadata from a traditional solution, chances are you will see a performance boost right out of the box without any tuning. But there are still opportunities to improve on that with tuning.” —Energy company, database team manager

Exadata customers were surprised that conventional DBA practice of adding indexes was not helpful with Exadata; in fact, indexing actually backfires: *“Exadata really pushes you to get rid of most of your indexes, we spent most of our time performance tuning by removing indexes. My advice—on a new system, start with*

³ Several customers described improvements over their prior solution, but could not compare Exadata to a more recent IBM P770. However, in two cases customers had migrated from IBM Power Systems to Oracle Exadata, and those examples carried extra weight given the opportunity for additional comparison.

I replaced three IBM Power Systems with a one-half rack Exadata server. I don't need three times as many data servers because I could house it all on one Exadata very comfortably.

--Business Services Company, Manager of Database administration.

no indexes and work your way up—you'll freak out most DBAs," said the DBA at Exadata customer and marketing services outsourcer. A DBA at a telecommunications company explained, *"Exadata has its own indexing in the storage array—causing some things to run faster without indexes."*

Exadata's high performance has been well-documented, but FactPoint's research found specific confirmation from two customers who converted from IBM Power Systems over to Oracle Exadata and could compare their experience.

In the first case, a logistics service had moved its Oracle data warehouse that was utilizing 75% of an IBM P570 to an Exadata Quarter-Rack, where the same application ran with just 5% CPU utilization.

In the other, a telecommunications carrier saw "astronomical" improvements when it moved its databases on P770 to Exadata, "Some queries ran 10X faster, especially those dealing with large amounts of data such as whole table scans and full partition scans."

Added the VP of Technology Infrastructure of the marketing services outsourcer, *"We were looking for a game changer and Exadata was a game changer for us."* He detailed performance improvements:

- 1.5X – 12X improvements in performance for load and updates.
- Query testing on 320 million rows, a process that previously took 5.5 minutes ran in 27 seconds, 12 times faster.
- *"60% of our queries ran at least 5X faster than the existing box, 95% ran at least 3X faster. A very small percentage ran slower, and we were able to fix all of those."*

The manager of database administration and data warehousing at another buyer, a business services company, pointed to Exadata's superior price/performance over IBM Power Systems: *"On our one Exadata box we have web applications, data warehouse and a development instance. I replaced three IBM Power Systems with a one-half rack Exadata server. I don't need three times as many data servers because I could house it all on one Exadata very comfortably. I could handle the throughput because I have InfiniBand that draws stuff out of that database at lightning speed. And the utilization of that system is sometimes almost not seeable—we are talking single digits."*

Exadata's high performance translated into other business advantages:

- **Strategic gains:** *"The tactical advantage is that existing queries run faster. You can run more existing queries at the same time. The strategic advantage is that you can do different kinds of analysis that requires you to process lots more data,"* said the CIO of a logistics company.
- **SLA compliance:** Service organizations offer customers Service Level Agreements as contractual commitments. *"Fundamentally we were failing about 70% of those SLAs,"* said the head of infrastructure and network delivery for a financial services firm that switched from IBM to Exadata. *"By bringing in Exadata, overnight it drastically reduced failing SLAs by >70%."*
- **Moving faster than ever before:** The logistics company made advances not previously attainable in its data warehouse operations; *"Data warehouse loads cut from four hours to 30 minutes, prior scheduling backups became easy, reporting ran much faster, back-ups went from 14 hours to 45 minutes, weekly updates of stats went from 60 hours to 35 minutes, the nightly load went from four hours to 20 minutes. A lot less handholding, a lot less exception management,"* said the CIO.
- **User satisfaction:** Users of the data warehouse have far fewer complaints after Exadata was implemented. *"The unique architecture of Exadata is a clear differentiator in the data warehouse space for the folks responsible for making the data loads run every night, the people running queries, the people trying to do the data-mining,"* said the CIO of a logistics company.
- **Flexibility:** The database team manager at an energy company hopes to move other workloads onto Exadata: *"We are very pleased with what we have seen out of Exadata. We have a number of Oracle databases that reside on older physical hardware or a VMware server. Eventually I would like to move them onto Exadata."*

Exadata requires 40% fewer systems administrator hours annually to operate and maintain

Operations and Maintenance includes the ongoing labor costs for installing software patches and upgrades, deploying applications, administering the database, and maintaining hardware and other infrastructure components, monitoring, diagnostics and troubleshooting.

Compared to IBM Power Systems customers, the research found that Exadata required 40% less systems administrator time because a lot of that role can now be

handled by a DBA, in the case of Exadata. Exadata customers also reported shorter support calls and faster diagnostics and troubleshooting. While the time savings are significant those benefits produced only modest total cost savings because the cost of operations and maintenance is a relatively small piece of total cost of ownership. In summary, Exadata allows customers to:

- **Scale capacity and improve performance without hiring more people.** *“Ongoing Operational support of the Exadata solution has been absorbed by our existing team even as workloads increase and SLA compliance improves,”* stated the Head of Infrastructure & Network Delivery at a financial services provider.
- **Avoid finger-pointing:** Because the entire Exadata stack is Oracle, customers avoid the game of “Whose problem is this anyway?” that often characterizes multivendor environments. *“Deciphering whose problem it is can be where the lion’s share of where the work is spent,”* said the director of information systems operations at a major retailer that runs its Oracle database on IBM Power Systems hardware. At another IBM customer, a telecommunications firm caught up in a finger-pointing episode that lasted months, a DBA added: *“A lot of the time was proving we really had a problem.”*
- **Achieve faster service requests:** The manager of a database team at an energy company sees benefits in diagnosing and troubleshooting performance issues with single-vendor Exadata compared to a mixed vendor environment. *“Before Exadata, when we would open a Service Request with Oracle support we would spend the first half-day answering questions about what exactly are you running this on, how much memory do you have. When we log in a ticket on our Exadata, they know what we have. It’s just a question of whether we have a quarter-rack or a half-rack, if that even comes up.”*
- **Gain headroom:** Exadata customers said that utilization rates of running the same applications often ran in single digits due to dramatic performance improvements; this operational headroom, especially compared to their prior, less powerful Power machines produced two results.
 - First, that reserve capacity helps IT administrators save time by protecting performance during system changes and by scaling more simply.
 - Second, the headroom leaves plenty of room for the database system to grow, says the manager of database administration and data warehousing for a business services company: *“Get me a structure that I can easily evolve without the full cost of implementing new hardware every time we turn around. Exadata is a no brainer to me. We bought a half-rack with 48TB of storage and I can grow on that Exadata machine for a long time.”*

With Exadata, “there is no finger pointing because the whole stack is Oracle,”

--Head of infrastructure and network delivery at a financial services firm.

In addition, Oracle's effort to innovate a new process for Exadata software patches and upgrades initially ran into some customer resistance. Instead of issuing frequent bug fixes separately for each element of Exadata, Oracle releases a single bundled patch on a quarterly basis. Bundled patches are intended to avoid system downtime and save cost by automating highly manual patching processes. Exadata's bundled patch consolidates what is a fragmented process on the IBM side. An IBM customer confessed:

"I haven't done a patch in 340 days. That tells you it is almost impossible to do. I have to affect the business to patch it. We are in the habit of delaying patches until there is a critical need." —Business Services (IBM Customer), DBA

However, some Exadata IT administrators worry that if a bundled patch triggers a problem, they will have trouble pinpointing the source of the problem in the huge software patch: *"If something goes wrong, which one of the 100 things in the patch is the thing that broke it?"* asks the CIO at a Logistics Service Co..

In response, some Exadata customers initially chose to outsource patching to Oracle professional services or an Oracle partner. Oracle now includes free of charge, the application of quarterly bundle patches with its Platinum Support service, and several Exadata users said Oracle has improved the patching process, thereby lessening anxiety. *"Now Oracle is offering Platinum support for patching and upgrades,"* said the database team manager at an energy company. *"Hopefully it will make it that much easier for someone to go Exadata."* Nevertheless, multiple customers plan to learn the procedure for Exadata patching themselves.

"For us and some of our peers who are using Exadata, the DBA is evolving into a DMA or Database Machine Administrator."

--Energy company database team manager

The beginning of an IT revolution?

Exadata's most revolutionary aspect for IT administrators lies in the way it is breaking down siloed job roles and organizational structures, introducing flexibility into long-standing IT practices.

"My DBAs are now system administrators and storage administrators and the network administrators for Exadata—we do more than just pure DBA work. I have talked to other Exadata users, not just one or two and a lot of them are doing the same thing for the same reasons." said the energy company's manager of a database team.

For this emerging Database Machine Administrator (DMA) job category, IT employees are cross-trained to handle tasks currently undertaken by admin

specialists in hardware, operating systems, network, applications or storage. IT managers who pursue this adaptive path likely will gain operational efficiencies for managing packaged solutions, although it may take several years as IT administrators are trained in new competencies.

The emergence of the DMA also may help restructure IT departments into more efficient operations, but the full benefits of this development cannot be fully realized until most older systems that demand a stove-piped IT organization are decommissioned and IT organizations adapt. At that time, IT operations managers may be able to reduce headcount. In time, packaged solutions should involve not only fewer workers but also fewer IT groups, which should reduce costs; in the meantime IT will be able to do more without adding headcount.

This change in job roles is not necessarily comfortable for everyone in IT because Exadata marginalizes various system administrators as it empowers the DBA:

“The DBAs are doing more hardware tasks and diagnostics because most of the Exadata stuff is geared around database commands, not hardware commands or operating system commands. The gearheads have designed Exadata from the DBA’s perspective—when you look at the sys admin portion, it’s all written by a DBA, not by a Sys Admin,” lamented a System Administrator at a Business Services Co.

Other System Administrators have expressed similar sentiments as many of their traditional responsibilities shift towards the DBA—the source of the much of the operational savings we have identified.

Comparison of Operations and Maintenance Labor

A comparison of operations and maintenance labor for the whole Exadata versus IBM P770 plus the Oracle Database solution shows annual 9% man-hours benefit from using Exadata, primarily from 40% less hardware systems administration time (server and storage) because of the integrated nature of Exadata. The Oracle database maintenance cost is the same for both Exadata and P770. Because the bulk of the man-hours in this category are for the cost of the DBA (see table below), it obscures the overall maintenance cost savings for Exadata. In addition, the TCO model includes outsourcing Exadata software patches for the first year only, bringing that function in-house for years two and three as customers develop comfort with bundled patches.

COMPARISON OF OPERATIONS AND MAINTENANCE LABOR

	Oracle Exadata Half Rack (48 cores)	IBM P770 48 cores/ DS8800 storage
Non- DBA Labor*	319 man-hours/yr	532 man-hours/yr
DBA Labor	2080 man-hours/yr	2080 man-hours/yr
Total Labor	2399 man-hours/yr	2612 man-hours/yr
3yr Labor Cost	\$578,688 (yr1 upgrades and patches outsourced at higher labor rate)	\$619,044

See Appendix B for details about the configurations we compared

Highly scalable and available

Exadata has been pre-engineered for easy scaling from an Eighth-Rack to a Half-Rack to a Full Rack (and beyond). Participants confirmed Oracle’s claim that Exadata eliminates the long-standing tradeoff between scalability, availability and cost. An Oracle DBA at a logistics service noted how the combination of Oracle RAC⁴(Real Application Clusters) and Exadata worked for his company:

“RAC has worked out to our benefit. Yesterday we had a small panic in the cluster, one node went down and it quickly restarted by the time I got on it, it had bounced and restarted and it was back and integrated into the cluster—so some of the fault-tolerant features are very helpful. It manifested itself as a slowdown versus an outage.”

Comparing the acquisition costs

To compare acquisition costs, an IBM P770 solution was pitted against a Half-Rack of Exadata, with carefully selected configurations for each. Acquisition includes the one-time costs of purchasing the hardware and the software. The configurations

⁴ Oracle RAC is a database cluster with a shared cache architecture that overcomes the limits of traditional shared-nothing and shared-disk approaches to provide highly scalable and available database solutions.

presented in the table below represent a composite of end user systems among interviews, guided by the participant profiles and *research findings*. One participant had migrated from P770 to a Half-Rack of Exadata.

COMPARING THE ACQUISITION COSTS

See Appendix B for additional detail about the configurations we compared

	ORACLE Exadata 48 cores total		IBM P770 48 cores total	
	Processors/Disks	Price	Processor/Disks	Price
Software				
	48 Intel Xeon Cores 4 database servers with 12 cores each and 7 storage servers		(3) 3.3 GHz 16 core (48 cores)	
Oracle Enterprise Edition	24 processors	\$1,140,000	48 processors	\$2,280,000
RAC	24 processors	\$552,000	0 processors	\$0
Storage License	84 disks	\$840,000	96 disks	\$0
Total Software Price		\$2,532,000		\$2,280,000
SW Discounted 20%		\$2,025,600		\$1,824,000
Hardware				
Server Hardware Cost	½ Rack Exadata w/high performance storage	\$625,000		\$443,000
Storage Hardware Cost - High Performance	w/84 600GB 10K rpm SAS	\$0	IBM DS8800 951 w/96 600GB 10K rpm SAS	\$2,387,000
Total Hardware Price		\$625,000		\$2,830,000
HW Discounted 20%		\$500,000		\$2,264,000
Total HW and SW discounted 20%		\$2,525,600		\$4,088,000

Many of the IBM customers interviewed, rather than buy dedicated storage with their P770, had connected their P770 to pre-existing NAS or SAN storage infrastructure to store the Oracle Database on. However, because Exadata includes storage, the comparison must add the cost of new storage for the IBM configuration. The high-end IBM DS8800 storage device was selected not only to match Exadata's high performance, but also because it was used by one IBM participant. This conservative comparison matches 84 HDDs on the Exadata side against 96 HDDs for the DS8800 with enough flash memory to match Exadata. We chose 96 HDDs on the DS8800 since the DS8800 is configured with disk sets, each set consisting of 16 HDDs. This is a very conservative comparison since we did not factor in the storage capacity savings that Exadata customers can achieve with Oracle Hybrid Columnar Compression (HCC). Customers would require significantly more storage and higher cost on the IBM side of the comparison to achieve the same storage capacities without HCC.

Oracle RAC, which supports deployment of a single database across a cluster of servers for fault tolerance from hardware failures, is included in the Oracle Exadata configuration but not in the IBM P770 configuration. None of the IBM Power Systems participants were using RAC while four of the five Exadata participants did. Therefore, it is unlikely that IBM would propose RAC in this situation, but it

“We didn’t think Exadata would have a fighting chance [in our TCO analysis of Exadata versus IBM Power Systems]. We thought the TCO analysis [our own] would point us towards traditional hardware, but it was a surprise to me that it was far in Exadata’s favor. We saved money mostly on license and storage.”

—Energy company, database team manager

would need some other mechanism to protect against a P770 failure, again understating the cost assumptions for the IBM system.

The calculations address a single production system. Based on these configurations (see a full list in Appendix B), acquisition cost for the Exadata versus Oracle on IBM P770 show that the Exadata acquisition cost was approximately \$1.5 million lower than the IBM solution. Pricing includes a 20% discount from list price on each side; a discount that FactPoint believes is conservative.

As a DBA at a business services company (and Exadata customer) noted, “You need a long-range plan, and you need to face the fact that you need to make X-investment this year, which will allow you to get out ahead of the curve, buy in bigger bulk, and get a shorter cost of ownership over the time.....when you balance it out you will have spent less in the next five years for ownership than you will if you keep being reactionary and adding on, adding on, adding on.”

While cost savings are a major factor, it was not always the most important element. Apart from the advantages for IT, Exadata purchase decisions often were driven by business factors, not IT.

“The decision to replace the data warehouse with Exadata is NOT going to be made because I can prove cost of ownership will be reduced over a five-year span. That is not why we will get it. We will get it because the business need will dictate it—our SLAs to our customer, our ability to fulfill the promises we make in our RFP and contract processes,”—Business services firm, manager, database administration and data warehousing

Pricing the Comparison

Comparing the cost of the same Oracle database software for these two scenarios⁵, licenses cost more for IBM Power Systems hardware than for the Exadata bundle because of a concept Oracle calls “core factor.”⁶

⁵ In calculating purchase software prices in this white paper, FactPoint normalized the costs of the Oracle database across different scenarios that emerged in the research by assuming that customers pay for all Oracle licenses as part of an either Exadata or IBM Power Systems purchase. In practice, customers often shift existing Oracle licenses from their old system to the new one. Without normalizing license fees, that practice would distort the comparison.

⁶ Oracle software pricing uses the concept of “core factors.” Core factors determine the number of multi-core processors that can run Oracle software. For hardware with a 0.5 core factor (Exadata),

“Oracle licensing cost was the driving factor in moving off IBM and onto Exadata.”

– Logistics company
CIO

The impact of core factors is that more powerful processors used in the IBM hardware are charged more for database software than Exadata, which runs on standard x86 processors.

That pricing model gives Exadata a significant cost advantage because Exadata's 48 cores require only 24 Oracle database licenses while the IBM P770's 48 cores require 48 Oracle licenses.

“Core Factor for any Intel platform is .5; Oracle is trying to price based on perceived performance benefit. But Intel processors have gotten so good over the years it's become a bargain to run Oracle on those processors.”

– Kerry Osborne, CTO and co-founder, Enkitec

Exadata's storage compression translated into buying less storage: A marketing services company with seven production databases that total 20TB noted that Exadata's compression saved 29% on its first database and 37% on second database. *“An uncompressed database of 20 terabytes would be closer to 30 terabytes if we didn't have compression,”* the VP of technology infrastructure said. *“It's impressive.”*

Exadata's HCC compression, included in Exadata, benefits users running data warehouses, but not users running online transaction processing (OLTP) option. For OLTP compression Oracle offers an “Advanced Compression” option. To be conservative in our analysis, we have not factored in the benefits of HCC in this TCO comparison even though many customers of HCC have attested to its benefits. Customers that utilize HCC typically see greater cost savings than what is presented here in this study.

The IBM configuration's ability to utilize existing storage made Exadata's built-in storage a less attractive option to some customers who had already invested in shared storage infrastructure. As an IBM government customer DBA said, *“Anything we buy has to work with everything we have.”*

the customer could run on an Oracle database on two cores for the same price that it could run the same Oracle software on one core of a IBM P770 (1.0 core factor). The core factor method is designed to equalize productivity for faster, more efficient processors.

This customer research validates that the Exadata engineered solution is a TCO bargain compared to running the Oracle database on the IBM Power Systems, based on FactPoint’s comparison of a Half-Rack of Oracle Exadata versus a similarly capable combination of an IBM P770 with DS8800 storage.

While Oracle promotes savings from rapid deployment and ongoing operations and maintenance, FactPoint found that Oracle Exadata customers will not have to wait three years to claim their comparative savings. This research found that Exadata is a price/performance superstar that delivers a large amount of value in a surprisingly bargain-priced package when compared to a traditional alternative. But over time this new product format, the “engineered system,” will increasingly save customers money on operations and maintenance as job duties and organizational structures adapt to the efficiencies of this integrated infrastructure.

As the table below summarizes, FactPoint found that the total cost of ownership over three years for the IBM P770 solution configuration was 31% higher than for Exadata, \$6.1 million for IBM versus \$4.65 million for Oracle Exadata.

IBM 3 YEAR TCO IS 31% HIGHER THAN ORACLE

See Appendix B for details about the configurations we compared

TCO Model		ORACLE Exadata ½ rack w/84 600GB 10K SAS		IBM P770 w/DS8800 w/96 600GB 10K SAS
Acquisition Cost- List Price- 20%		\$2,525,600		\$4,088,000
Implementation Labor Cost		\$10,461		\$10,603
Annual O&M Labor Cost		\$578,688		\$619,044
Annual Support Fees- Software	22%	\$1,336,896	22%	\$1,203,840
Annual Support Fees- Hardware	12%	\$180,000	13.5%	\$143,532
Annual Data Center (Power and Cooling)		\$24,126		\$43,728
TOTAL 3 YR TCO		\$4,655,771		\$6,108,747
TCO Differential --- 1.31				

After acquisition costs, annual support fees for both software and hardware have the second largest impact, followed by annual operations and maintenance expenses, presented in the table over a three-year period, with the IBM alternative proving more costly. The costs of power and cooling, where Oracle Exadata offers some green benefits over the traditional IBM Power Systems solution, dwarf the equal costs of implementing either IBM or Oracle Exadata, \$24,126 over three

years for Oracle Exadata versus \$43,728 for the IBM configuration. (See Appendix A for power and cooling calculations.)

The largest category of savings came from acquisition costs of hardware and software —\$2.5 million for Oracle Exadata versus \$4 million for IBM, taking a 20% discount from list prices for both alternatives. For IBM, the acquisition cost includes DS8800 storage hardware. Because storage is included in Oracle Exadata, there is no corresponding cost on the Oracle side.

Exadata support costs were higher for two reasons:

1. RAC was included in the Oracle Exadata configuration but not in the IBM configuration.
2. Because the IBM DS8800 storage comes with a three-year warranty we did not include annual support for the storage in the cost calculation for the IBM configuration.

FactPoint believes this comparison is reasonably conservative, although Oracle would argue that much more IBM horsepower would be required to match the performance of Exadata.

About The FactPoint Group

the FactPoint group

The FactPoint Group is a Silicon Valley-based research, publishing and consulting firm specializing in early adoption of new solutions and technologies. It has produced world class research, analysis, and consulting since 1993.

To learn more about The FactPoint Group and this research, please visit www.factpoint.com or contact: Larry Gordon, Partner at gordon@factpoint.com or (650) 559-2105

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APPENDIX A: TCO Model Assumptions

The TCO model focused on three different areas.

1. **Acquisition cost:** List prices were discounted 20% for both IBM and Oracle systems. For Oracle database software, licensing costs are based on the concept of “core factors,” which determine the number of multi-core processors that can run Oracle software. For hardware with a 0.5 core factor (Exadata), the customer could run on an Oracle database on two cores for the same price that it could run the same Oracle software on IBM P770 (1.0 core factor).
2. **Labor Rates:** The TCO model that FactPoint developed for the Exadata comparisons calculated labor rates for in-house resources at a fully loaded cost of \$79/hour. Rates for IBM and Oracle standard professional services were calculated at \$255/hour, and Oracle partners’ rates were \$190/hour. These rates were used for calculating implementation and for operations and maintenance (O&M) costs.
3. **Implementation and Deployment Labor:** Costs were calculated based on getting the machines “ready for data” and based on the number of man-hours to complete the work, not elapsed time.
 - a. **Testing, database migration:** The work of testing the new systems and migrating data onto the new database were excluded from the cost model because these varied significantly among interviews and no pattern emerged for IBM versus Exadata. Including these two cost categories would not have changed results significantly.
4. **Ongoing Operations and Maintenance:**
 - b. **Operations and Maintenance Labor:** Because IT teams typically allocate their time across multiple systems, the man-hours estimates for each activity are best-effort approximations by the participants.
 - b. **Annual software and hardware support fees:** Based on a percentage of acquisition costs, support fees are affected by how large a discount a customer actually gets. Oracle’s hardware support fee is 12% of purchase cost while IBM’s is estimated to average 13.5% for the configuration we studied. Oracle database support is 22% in either scenario. IBM does not include all the same services as standard priced options, compared to what is included as standard with Exadata support.

- c. **Power and cooling:** Calculations for costs of power and cooling are based on vendor literature and assume a 1:1 relationship between power and cooling as well as energy consumption at about 70% of the maximum rated level. Cost of energy is assumed to be \$.09/kWh. Calculations for costs of power and cooling are presented in the tables below.

POWER AND COOLING CALCULATIONS

See Appendix B for details about the configurations we compared

		Exadata Half Rack	IBM P770	IBM DS8800
Energy Consumption	Max kW	7.2 kW	6.4 kW	6.7 kW
	Typical	5.1 kW	4.54 kW	4.7 kW
	Cooling*	5.1 kW	4.54 kW	4.7 kW
	Duty cycle	8760 hrs/yr	8760 hrs/yr	8760 hrs/yr
	Total	89,352 kWh/yr	79,611 kWh/yr	82,344 kWh/yr
	Cost/kWh	\$.09/kWh	\$.09/kWh	\$.09/kWh
	# yrs	3	3	3
			\$21,495	\$22,233
Power and Cooling Costs		\$24,125	IBM TOTAL	\$43,728

*Assumes 1:1 relationship between energy requirements for power and cooling

Other costs were not included in the TCO model for the following reasons:

Other business benefits: Benefits to an individual company's operations, profitability or revenue are presented outside the TCO model because the benefits are specific to that company's business model and thus difficult to quantify generically. They are nonetheless real benefits that individual companies may be able to quantify for themselves. They are described using quotes from interviews.

APPENDIX B: Configurations Used for TCO Comparison

The configurations selected to compare acquisition pricing were identified after the research interviews had been completed, and were guided by participant profiles and research findings. The goal was to create two equivalent scenarios that accounted for cores, processor speeds, size and type of storage. For example, Oracle RAC is typically deployed with Exadata configurations but not for IBM – of note, IBM would require additional HA failover software to match this key Oracle capability. Also, the IBM P770 was selected not only because it is IBM’s latest generation but also because it is one of IBM’s most popular models to date, and also one of the customers interviewed had specifically migrated from a P770 to Exadata.

Many IBM customers interviewed were using their existing NAS or SAN storage infrastructure, although one customer uses IBM’s DS8800. For the IBM configuration, FactPoint priced 6- 16-disk units of the DS8800 to match Exadata’s high performance. The benefits of the HCC compression included with Exadata have not been factored into the analysis because the degree of compression can vary widely across different implementations. Oracle would state that up to 10 times the number of hard-disk drives would be required on the IBM side to match the capabilities of Exadata. IBM’s three-year warranty on the DS8800 storage reflects in lower ongoing support costs. The table below details the systems that were compared:

EXADATA HALF-RACK VERSUS IBM P770 WITH DS8800 STORAGE

	Exadata Half-Rack	IBM P770 with DS8800 Storage	
		IBM P770	DS8800/95E Storage
Processors/Cores	4 database servers with 2 x Six-Core Intel® Xeon® X5675 Processors (3.06 GHz) (48 cores total)	(3) 3.3GHz POWER716-core (48 cores total)	
Memory	384 GB	384GB	
Server Storage		(2) 300GB SAS 10K rpm 2.5" HDD	

OS	Oracle Linux or Solaris 11	AIX Standard Edition V6.1	
Storage Capacity (High Performance)	50TB Raw (84 600 GB HDDs 2.6 TB Raw Flash Capacity)		58 GB Raw- (6) 600GB 10,000rpm 2.5" SAS Drive Sets@16 drives each (96 drives total) 2.4 TB Flash- (8) 300GB 2.5" SSD
Storage Grid CPU Cores	Exadata Storage Servers with 2 x Six-Core Intel® Xeon® L5640 (2.26 GHz) Processors		System Storage 4 Way Processor Card System Storage 32GB Processor Memory
Networking*	3 InfiniBand Switches User networking: 16 x 1 Gb Ethernet Ports and 8 x 10 Gb Ethernet Ports	(3) Integrated, 4 Port- 1Gb Virtual Ethernet, I/O ports	4 active Fiber Channel ports, 2 Ethernet IP ports System Storage 8Gb 4 port SW FCP/FICON Adapter PCIE <i>*Configuration assumes pre-existing Fiber Channel Switch</i>
Management	1 Ethernet Switch KVM for local management	Hardware Management Console	System Storage Management Console Tivoli Storage Productivity Center
Warranty	1 yr warranty on hardware	1 yr warranty	3 yr warranty