White Paper

Oracle Databases Achieve Unprecedented Speed Running on the New Exadata Database Machine X8

Wherever Oracle Databases Live and However They Are Consumed, Exadata X8 Delivers Performance in a League of Its Own

By Mark Peters, Principal Analyst & Practice Director

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Introduction and Executive Summary

Many things in IT are talked about a lot just because they *have* to be, while other things are talked about very little because they *cannot* be. As examples: There are lengthy written guides and web communities based on myriad approaches to *system integration* because (let's face it) a lot of IT over many decades has been about trying to make operational round pegs fit application square holes. On the flip side, "unique" is a word that is eschewed by pretty much everyone except for vendor marketing departments because (let's face this, too) there's a lot of similarity across many capabilities from much of the vendor community. The journey may vary a tad, but the destination is often similar.

Oracle Exadata Database Machine has now stood for a full decade in stark contrast to both these "norms." As an Oracle Engineered System, the need to talk about integration is essentially precluded; the same engineers who build Oracle Database also ensure the Exadata is a seamless place to run the software. Control of all the IP means Oracle has a controlled and predictable environment in which to run its Database on Exadata, which in turn means it can deliver features that bring additional business value to its customers and enable them to obtain additional operational benefits and financial payback from their Oracle Database investment.

And that's it in a nutshell: Oracle's justifiable claim to be providing, with Exadata, the best platform for Oracle Database is derived from it having the same DNA across both elements. That commonality helps make it economically attractive, scalable, and secure. It also generates the contrast that Oracle fairly enjoys making when comparing Oracle Database running on Exadata to Oracle Database running on any other vendor's equipment; the others are constrained to essentially treat Oracle Database like any other application sitting on a VM or running as a process on generic hardware. Exadata delivers incremental business value when combined with Oracle Database, whether in the cloud or on-premises. The arrival of Exadata X8 provides yet another positive turn of the specification—and hence, value—screw, while Exadata turning ten years old is a timely reminder to review the power of the platform in general. It's a power borne by suitability; and to appreciate that suitability, a quick reminder of the database market and its data needs is warranted.

Databases: Their Market and Their Varied, Voracious Data Demands

The Database Market

Databases have long served as the lifeline of crucial business applications, and thus are often a foundation of businesses. Contemporary IT—and the world as we understand it—could not function without databases. But exponential data growth, the need to support more database workloads, and the resulting database sprawl have created significant challenges for IT organizations…challenges that are now complicated and extended by the arrival of multiple iterations of the cloud. With most organizations having mandates to adopt the cloud to some extent—database workloads are no exception—they should look to a partner that can not only meet their on-premises requirements, but also provide a path to a cloud that best fits their needs. And for many, getting an identical user and operational experience would be perfect. Moreover, as much as the IT environment has changed, so have the databases themselves…such as Oracle's latest 19c iteration. These are not the databases of past generations, and so you wouldn't want to use obsolete approaches of the past to serve them their lifeblood (i.e., data).

Database Data: Proliferation, Demands…*and* the Cloud

Managing data growth and database size are far and away the greatest challenges organizations face in their current database environments, cited by 48% of respondents in ESG research (see Figure 1).[1] Other key aspects of contemporary database environments include:

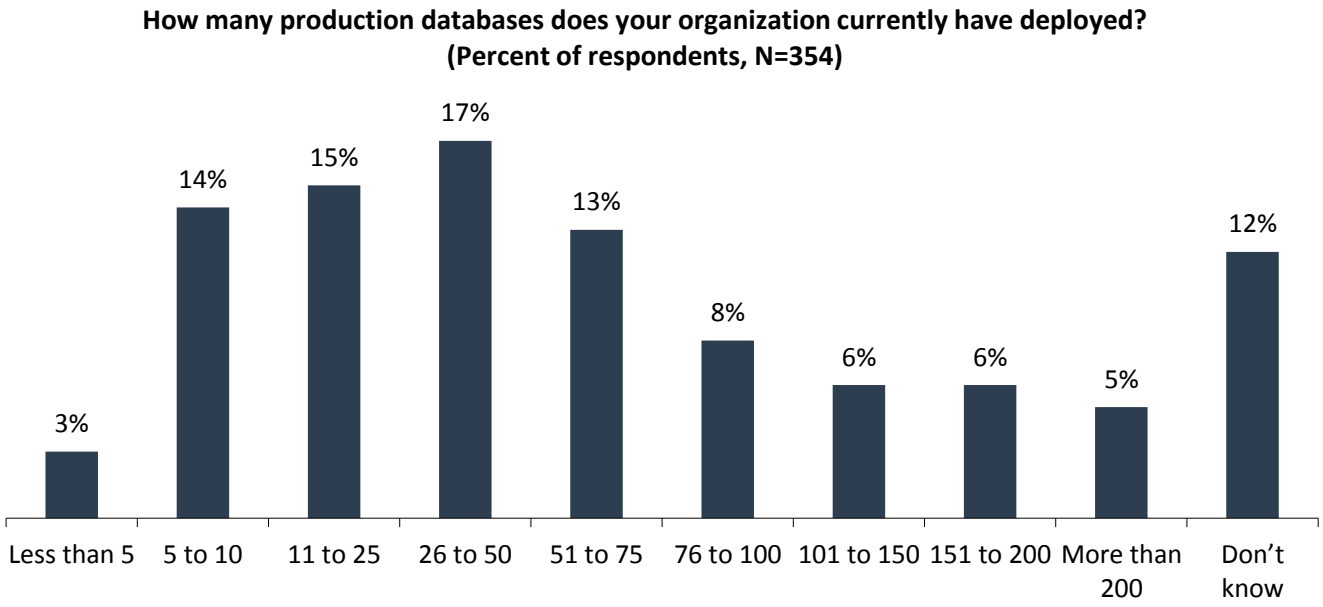
[1] Source: ESG Survey, *Enterprise Database Trends*, January 2017. All ESG research references and charts in this white paper have been taken from this survey, unless otherwise noted.

- Additional top challenges are database performance, supporting databases in cloud environments, and the drive for ever-better security and compliance. This is not a pick-and-mix list; users need solutions to all of these problems from their chosen vendor.
- If organizations had only one database, life would certainly be easier; but ESG research shows 55% of organizations have more than 25 databases in production, and having hundreds is not at all rare (see Figure 2). These tools support everything from transactional and analytical workloads to the latest machine learning applications, and they can be running everywhere from on-premises through "cloud-adjacent" environments to the cloud.
- Often databases are siloed (with their own infrastructure), which compounds the management complexity and leads to inefficient utilization of hardware and software investments.
- Maintaining multiple independent environments results in complex and growing security controls/policies, access needs/rules, and patching requirements, and this only adds to the management headaches IT organizations are forced to either suffer through or try to address.

Figure 1. Challenges with Database Environment and Supporting Infrastructure

Source: Enterprise Strategy Group

Figure 2. Number of Production Databases Deployed



Source: Enterprise Strategy Group

The sum of the above—complexity and database iteration combined with data growth and the need to share it across and between organizations—is driving a need for consolidation. When ESG last investigated this, 50% of organizations were already consolidating databases, with another 25% planning on it. That consolidation in turn means DBAs must merge multiple workloads onto a given infrastructure, invariably creating more performance issues to be addressed.

And this is all before adding in the operational curve ball of the cloud! Database provisioning and consolidation exercises increasingly must acknowledge that the right platform can change over time. Not surprisingly, ESG's research has found that when evaluating and selecting databases, the most important attributes are that the database be capable of being cloud-based and include the ability to easily scale up and/or down as workloads demand.[2]

The Essence of Exadata, X8, and Cloud-enhancement as Desired

Good news comes in the shape of the "Oracle on Oracle and for Oracle" solution: Exadata. Its value proposition is a piece of cake to convey: It is an optimized platform on which to run Oracle Database. While Oracle Database can run on myriad other systems, the optimal experience is running it on Exadata. It is an Oracle Engineered System that is tuned to be best for Oracle Database and integrates unique value-add features that are unavailable from other vendors. As such, *it is not general purpose, nor simply fit-for-purpose: **It is purpose-built.*** Over its decade in the market, Exadata has grown as the—identical everywhere—foundation for on-premises, Oracle Cloud, and Oracle Autonomous Database operations. The company states that Exadata is run by 77% of the Fortune Global 100 (25% of which have also adopted Exadata Cloud Service).

This paper is not designed to provide extensive technical details, but suffice it to say Exadata is an ideal database platform that combines scale-out, database-optimized compute, networking, and storage *hardware* (to deliver both performance and economy) with smart *software* in the form of both specialized algorithms that can vastly improve all aspects of

[2] Source: ESG Brief, *Database Purchase Criteria*, June 2017.

database processing, as well as automated management to optimally handle configuration, updates, and performance.[3] Better yet, *all* the above is true across *all* workloads, whether they are petabyte-scale data warehouses or business-crucial OLTP applications, and whether they are traditional business applications or next-generation analytics and machine learning. Organizations can confidently consolidate their Oracle Databases and associated workloads onto a single platform born on-premises and then extend to some, or full, public cloud consumption options if desired.

With Exadata, Oracle is allowing its users to deliver against the common (but also not commonly well-defined or stable) mandate to leverage the cloud by providing paths to deploy cloud operating models ranging from optimizing on-premises infrastructure before moving to the public cloud,[4] through utilizing an on-premises cloud service (Oracle Cloud at Customer) that provides a public cloud experience but with the security and control of an on-premises environment, to a Cloud Adjacent offering,[5] and all the way to a public cloud deployment with Exadata Cloud Service or Autonomous Database.

Exadata X8

As with Exadata in general, this paper is not the place to conduct a lengthy exposition of the new Exadata X8. A few headlines serve to convey the arrival of not only dramatic specification improvements, but also some key functionality:

- Speed—Scale-out servers use the improved clock-speed of the latest 24-core Intel processors, as well as NVMe flash, to help Exadata X8 deliver up to 560GB/sec I/O throughput and 6.57M OLTP read IOPS (with 3.5M IOPS at under 250 microseconds). For obvious reasons, Oracle encourages all its prospects to compare its throughput and speed with typical all-flash storage arrays.

- Capacity—There are 40% higher capacity 14TB Helium disk drives (the highest capacity at which Oracle's prerequisite availability targets can be achieved). Additionally, a new Storage Server X8-2 XT expansion unit delivers dramatically less expensive storage for less-accessed, older, or regulatory data, *but* with all the benefits of Oracle Database storage (e.g., Hybrid Columnar Compression,[6] identical operations, and security/encryption). Think of this as seamlessly converging the data[base] in addition to converging the infrastructure.

- Function—60% more cores in Exadata X8-2 Storage Servers help offload more Oracle Database processing and also improve security by mitigating threats such as "Spectre" and "Meltdown" in silicon, eliminating software overhead. Also, automated, cloud-scale, full-stack performance management and monitoring combines AI and years of real-world performance "triage experience" with best practices to automatically detect performance issues, proactively determine root causes, and address problems without human intervention.

Exadata + Oracle Database: 'Hand in Glove' and Extended Value

While it is impressive and valuable to know about Exadata's specifications or extensive HA features, what really sets it apart are over 60 Exadata-only features for Oracle Database, such as Fast Node and Cell Death Detection, Automatic ASM Mirror

[3] In patching alone, for example, organizations can use Exadata to drastically reduce the number of patches. Oracle's website details a $200B retailer that has reduced its patches 95% p.a. This enabled its IT group to improve productivity, while allowing its DBAs to more easily ensure their infrastructure was up to date and reduce risk.

[4] The cloud alliance announced in June 2019 between Oracle and Microsoft further demonstrates Oracle's determination to be a key element in the public cloud world, while acknowledging that it will play to its strengths (such as high-performance Oracle Database) and allow customers to utilize the value of other mega-clouds as appropriate.

[5] This offering is outlined in the ESG White Paper, *The Business Advantages of Cloud Adjacent Oracle Databases on Exadata*, published March 2019.

[6] Hybrid Columnar Compression is an approach to database data compression that utilizes both the database and storage capabilities of Exadata to significantly reduce Oracle Database capacity requirements (10-15X is the norm). Less data handled also improves performance.

Reads on IO Error Corruption, Automatic Statistics, and many more. It's a veritable smorgasbord of delights for IT operations and DBAs to use, which delivers unsurpassed—and genuine—value to Oracle Database users.

Extensions to this unique hand-in-glove functionality have continued with the latest Exadata X8, most notably the machine learning that enables Automatic Indexing with Oracle Database 19c. A fully-automated capability based on technology from Oracle Autonomous Database (what Oracle refers to as a "self-driving database"), this improves database performance and eliminates manual index-tuning tasks for critical applications.[7] This means that DBAs can simultaneously stop the manual task of creating indexes for applications running on Oracle Database, achieve faster performance, and gain time to focus on more strategic business objectives.

Users can also use in-database machine learning without having to move any data. All the algorithms run inside Oracle Database—close to the data—which ensures no production impact. This delivers dramatic performance gains for actions such as the faster scoring and validating of models against the freshest production data.

While Oracle can at times display a love for extreme detail, Exadata's powerful core value makes that largely unnecessary. Simply, it is the most integrated, optimized, flexible, and capable place to run Oracle Databases, with a set of attributes that allow it to cost less, scale better, and be more secure than alternatives. As such, it has become a foundation for Oracle Autonomous Database and Oracle SaaS applications, and the architecturally equivalent stepping stone to Oracle Cloud.

The Bigger Truth

While the term "no brainer" is a tad simplistic and can overlook relevant adjacent factors, it is clear that unique capabilities and user-value are available with Oracle Exadata when it's used in concert with Oracle Database. That means any Oracle Database user not utilizing Exadata is missing out on some or all of those capabilities and value.

As Exadata X8 heralds the second decade for this offering, it has increased its deployment choices alongside Oracle Database to mirror the increasingly hybrid cloud world, and thus offers a congruence of architecture, features, and security wherever and however it is deployed—on-premises or in the cloud. Oracle also continues to add impressive functionality that can translate to not only IT improvements, but also business value; a prime example being the machine learning in Oracle Database 19C to enable auto indexing with Exadata X8.

Oracle is not famed for being shy in its own marketing claims; regarding the use of Exadata to run Oracle Database, it likes to say that the combination is "so smart that there's no second place." It would be easy to dismiss that as marketing bluster, but it actually deserves consideration; "second place" would suggest vendors competing at the same level…but really Oracle has put Exadata in a league of its own.

[7] Oracle reports a recent test in which 15 years of manual engineering were compared with what could be done in less than 24 hours with modern machine learning when the Automatic Indexing successfully created two-thirds the number of NetSuite application indexes and also increased database and application performance.

Enterprise Strategy Group is an IT analyst, research, validation, and strategy firm that provides actionable insight and intelligence to the global IT community.

 www.esg-global.com

 contact@esg-global.com

 P. 508.482.0188