ESG WHITE PAPER

Oracle Autonomous Database: It's Coming to a Data Center Near You

Actually, it's coming to *your* data center.

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July 2020

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Executive Summary

One of Oracle's latest introductions neatly manages to address both an increasing new need as well as a couple of age-old IT prerequisites. In so doing, it offers a "have your cake and eat it too" nirvana for those Oracle Database users that are compelled to deal with all three things at once.

- So, yes, we all know that organizations are increasingly turning to public cloud services to enable their businesses to be more agile, scale efficiently, and take advantage of flexibility in both operations and via pay-as-you-go consumption. With 45% of organizations reporting that they are running production applications in public cloud infrastructure services,[1] it's all too easy to think that this is the sole defining trend in contemporary IT. *However*, it is becoming just as clear that not all applications will reside on public clouds any time in the foreseeable future, if ever. For many organizations, compliance or regulatory requirements dictate that their data remains onsite. Many also simply prefer to keep their mission-critical tier 1-applications in their own data centers even though they would like to enjoy the key flexibility benefits of the public cloud. This is the "increasing new need" that is part of what underpins a new Oracle offering; it creates a nascent desire (which, once expressed, becomes a need) to have those cloud services and environments delivered in on-premises data centers. Oracle has been delivering and refining its Cloud@Customer solutions for over three years now to do just this.

- The "age-old IT prerequisites" are headed by the IT equivalent of the medical Hippocratic Oath, which we can express as "first (and last!) lose no data." Hand-in-hand with this is the constant demand to save money, invest wisely and "do more with less." Oracle's delivery of autonomous capabilities over the last couple of years (first, its eponymous database and then its Linux OS) is designed to address both these things. At the core, autonomous IT services eliminate human labor (which is costly) and human error (which can often be *extremely* costly). Beyond this, machine learning and automation simply represent a more efficient way to do things, which keeps costs optimized. Oracle's Autonomous Database has been available in its public cloud since 2018.

Oracle's progress has been impressive on each aspect, but an Oracle Database user with all three challenges—being constrained to on-premises, and demanding optimized database efficiency *and* effectiveness—has had to decide priorities and make choices because they could not address all three simultaneously. But no longer: Oracle is now offering its most popular cloud service, Autonomous Database, for a secure, on-premises deployment, leveraging a second-generation Exadata Cloud@Customer environment.[2] It is crucial to note immediately that this is *not* a stripped down nor a de-featured version in any way, but rather a full-strength, self-managed solution supported on Oracle's latest persistent memory-powered technology—Exadata X8M. This means a full suite of mature database services, which removes any need for users to consider rewriting mission-critical applications to use alternative, and less sophisticated, database cloud on-premises offerings. It is perfect for enterprises (such as Samsung SDS, an impressive early adopter mentioned in Oracle's announcement event) that want to deploy tier-1 database workloads in an on-premises cloud today and enjoy the best attributes of both the cloud and Oracle Database.

## Introduction: Accelerating Hybrid Cloud Strategies

It's no secret that organizations are rapidly adopting public cloud services. Those embarking on digital transformation initiatives are actively trying to become more operationally efficient and deliver differentiated customer experiences. ESG research has documented the steady adoption and growth of public cloud services over the last ten years. The data in

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[1] Source: ESG Research Report, *2020 Technology Spending Intentions Survey*, February 2020.
[2] For a full explanation of the attributes and value of the underlying system, see the ESG White Paper, *The Choice for How Best to Run Oracle Database as an On-premises Cloud Service is Clear: Gen 2 Exadata Cloud at Customer*, published September 2019.

Figure 1 shows that 94% of organizations report currently using public cloud services (IaaS and/or SaaS) to some degree. Furthermore, nearly half of the respondents currently using public cloud infrastructure services reported leveraging public cloud infrastructure services to run production applications.[3] This is a big change from five or six years ago when running production applications ranked at the bottom of the list of cloud use cases. There are compelling reasons why organizations have shifted, and continue to increasingly embrace, the cloud. Essentially, they want to take advantage of its agility, on-demand scale, and pay-as-you-go economics.

Figure 1. Public Cloud Services Usage
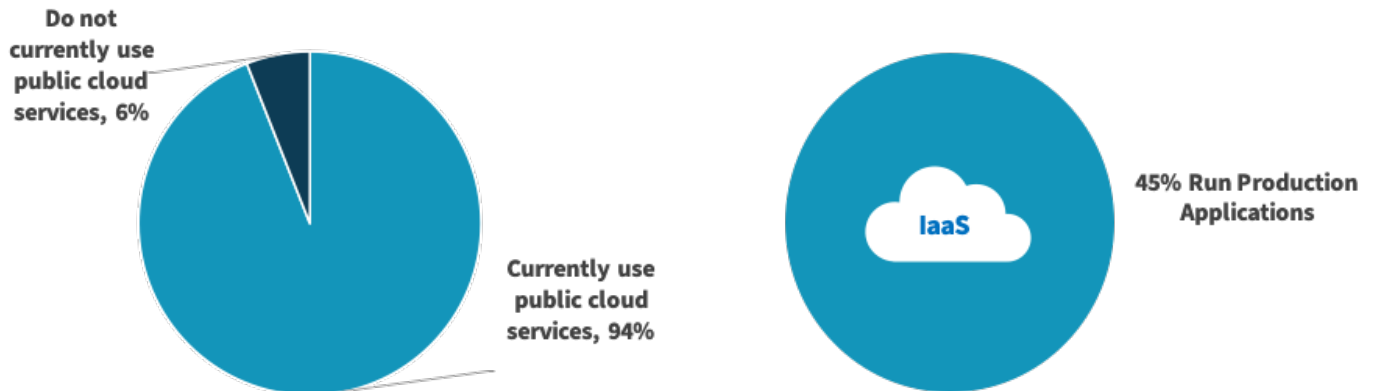
Source: Enterprise Strategy Group

Oracle is no stranger to the cloud. In fact, it is currently delivering its second-generation cloud infrastructure and services, including its widely used Autonomous Database. Currently thousands of customers are taking advantage of the Autonomous Database service in either a shared infrastructure model or a dedicated infrastructure model—but both in the public cloud. The shared model is very simple to use and highly standardized, enabling organizations to get started quickly and without requiring much Oracle Database knowledge. The dedicated model is still straightforward and intuitive, but it is also highly customizable and enables its users to specify configuration and lifecycle policies.

However, despite the massive shift to cloud services, our research also indicates that not every application is moving to the public cloud. Over half of ESG research respondents (53%) indicated that they decide application placement on a case-by-case basis, with some going to the public cloud and others remaining on-premises.[4] Organizations have several factors to consider, including the cost of refactoring applications, data sensitivity requirements, industry or government regulations, and mission criticality. Even for new, modern application architectures (such as microservices in containers), separate ESG research highlights that 70% currently/plan to run in hybrid cloud environments.[5]

Oracle has production-hardened its Autonomous Database as an industry-proven cloud service and is now addressing more user needs by offering the Autonomous Database as a service on its second-generation Exadata Cloud@Customer offering based on the latest X8M model.

Enterprises Require Proven Solutions

The simplicity of the new Autonomous Database on Exadata Cloud@Customer offering should be a welcome relief to the many organizations trying to keep multiple "IT plates" spinning, such as distributing applications and modernizing IT

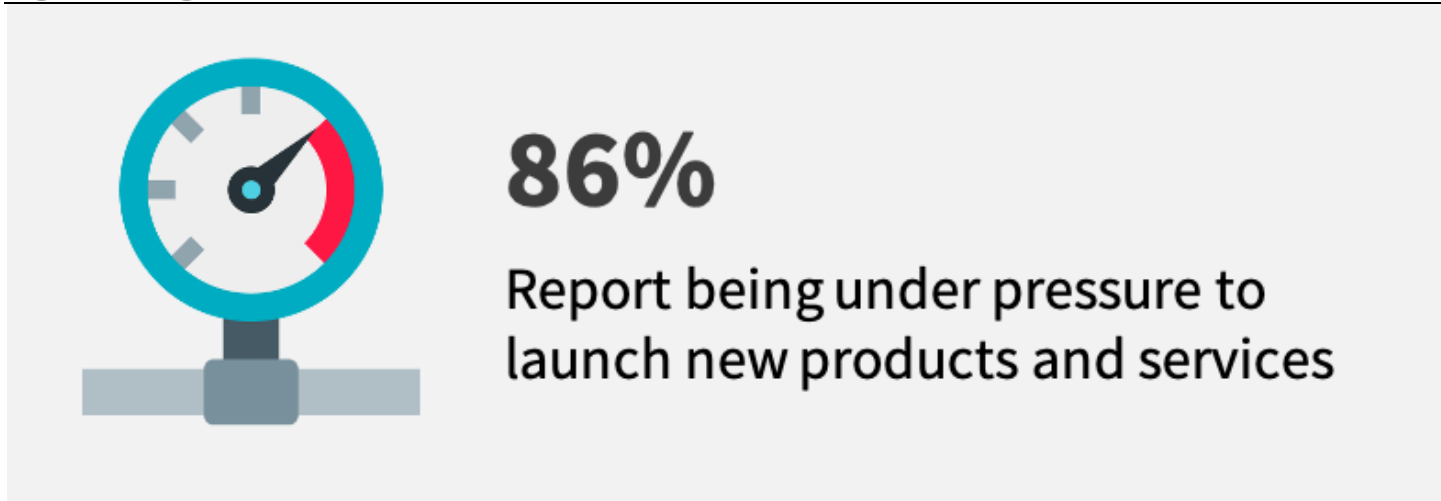[3] Source: ESG Research Report, *2020 Technology Spending Intentions Survey*, February 2020.
[4] Ibid
[5] Source: ESG Master Survey Results, *Trends in Modern Application Environments*, December 2019.

environments to become more agile while dealing with increased demands for scale, speed, and flexibility, *as well as* struggling with the resulting increased complexity of their IT environments. ESG research highlights that almost two-thirds of respondents (64%) report that their IT environment is either more, or significantly more, complex than it was two years ago.[6] The reasons for this complexity are likely self-evident: they include having applications distributed across data centers and public clouds, which requires operations teams to learn new management systems, or worse, create siloed cloud teams.

Consequently, organizations are increasingly realizing that the days of do-it-yourself (DIY) IT architectures are numbered, of necessity as much as by desire. This was true even before the COVID-19 pandemic but is now more acute. The thought of company IT teams trying to practice social distancing while they test, re-test and manage "pods" comprised of servers from one vendor, storage from another, networking from a third, plus the critical database and application layers—along with coordinating patching updates, patching versions, and tuning everything to make it all actually work together—is not only likely to create a migraine, but is also no longer practical. For organizations running Oracle Database, Autonomous Database on Exadata Cloud@Customer pre-packages the entire Database stack so there's no testing left to do, making it a smart choice for both the current market and the current world situation.

Another top complaint driving complexity is simply the ever-higher volume of data. As our global digital economy flourishes and IT infrastructure and devices generate massive and growing volumes of information, organizations struggle to stay in control and leverage their data effectively. This is especially true for database administrators, who are expected to keep pace with all this data and ensure that it is always available for users and application developers. Struggling to keep pace can lead to increased risk of manual errors and even sub-optimal database performance*,* which are both IT synonyms for increased cost and less-than-satisfactory user experiences. Given that 86% of organizations report being under pressure to deliver new products and services faster (see Figure 2),[7] organizations need proven, scalable, reliable database solutions to enable IT to regain control.

Figure 2. Organizations Under Pressure to Launch New Products and Services Faster

Source: Enterprise Strategy Group

While this is what Oracle's Autonomous Database service overcomes—and has been doing in the public cloud—many organizations can't use the public cloud but they crave those capabilities on-premises. How best might they get that? Some key motivations, potential constraints, and design considerations for such an on-premises offering include:

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[6] Source: ESG Research Report, *2020 Technology Spending Intentions Survey*, February 2020.
[7] Source: ESG Master Survey Results, *Trends in Modern Application Environments*, December 2019.

- **Obtaining true, proven cloud services in the customer's data center**, ideally with the same capabilities, not a subset, and enterprise-class performance as well. *Organizations running tier-1 mission-critical applications can't afford to be beta testers for unproven on-premises cloud platforms.*

- **Ability to scale**. Organizations want to leverage pay-as-you-go, but also have the flexibility to scale when needed.

- **Level of management required.** Is the on-premises cloud service fully managed or self-managed? If not self-managed, then what type of training and ongoing lifecycle management is required for the user?

- **Supporting infrastructure.** Is this supplied by the on-premises cloud provider or do users have to source their own? If so, who is responsible for correlating problems between the service and infrastructure?

- **Service and support.** Enterprise organizations demand a very high level of service and support for any infrastructure or service that hosts tier-1 mission-critical applications. Organizations need to fully understand who is providing that support and what SLAs are supported, including penalties for noncompliance.

Oracle Delivers with Autonomous Database on Exadata Cloud@Customer Powered by PMEM

Autonomous Database on Exadata Cloud@Customer represents the first time that Oracle's most advanced database is available on-premises. Previously reserved only for the Oracle public cloud, this new offering brings its full machine-learning-powered database to customer data centers, and at a 20% reduced cost for Exadata Cloud@Customer (which now starts at only $10,800 per month). Oracle has also enhanced its Exadata Cloud@Customer platform with its impressive X8M technology, which combines persistent memory and RoCE to bypass network and I/O software, interrupts, and context switches to improve latency by 10x for cloud workloads ranging from OLTP to fraud detection. Oracle clearly has an intent to "make business hay while the market opportunity shines" and grow its base across both on-premises environments and the public cloud while its principal database competitors (including AWS, Azure, IBM, Teradata, and others) have not delivered equivalent autonomous databases. When Oracle CTO and Chairman Larry Ellison states that "we think it's going to be one of our biggest and hottest products ever,"[8] it is nigh-on impossible to suggest hubris is at play.

Oracle is therefore delivering a significant step forward in accelerating the adoption of true hybrid cloud environments because Autonomous Database on Exadata Cloud@Customer:

- **Is exactly the same as the Oracle public cloud.** It's neither a "cloud-like" nor a "cloud-light" service with reduced capabilities or just providing pay-as-you-go consumption. The Oracle Autonomous Database delivers the same Database functionality on the same Oracle "Engineered System" infrastructure. *The only difference is the location*.

- **Uses ultra-high-performance second-generation cloud technology**. Oracle's Exadata Cloud@Customer X8M infrastructure uses RoCE and persistent memory (PMEM) to ensure the extremely high performance that is demanded by mission-critical tier-1 applications, not just marginally better than the current competitive offerings but better by one to two orders of magnitude.[9] For example, according to public information published on Oracle[10] and AWS[11]

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[8] Source: Oracle Q4FY20 earnings call transcript.

[9] The full extent as to how X8M delivers such performance is explained in detail in the ESG White Paper, *Demystifying Breakthrough Oracle Database Storage Technologies*, published December 2019.

[10] Exadata X8M data sheet https://www.oracle.com/a/ocom/docs/engineered-systems/exadata/exadata-x8m-2-ds.pdf and Exadata Cloud@Customer X8 service sheet https://www.oracle.com/a/ocom/docs/engineered-systems/exadata/gen2-exacc-ds.pdf (as of 07/01/2020).

[11] AWS sources (as of 07/01/2020) https://aws.amazon.com/outposts/pricing/, https://aws.amazon.com/about-aws/whats-new/2019/04/amazon-rds-for-oracle-now-supports-64tib/, https://docs.amazonaws.cn/en_us/AmazonRDS/latest/UserGuide/CHAP_Storage.html,

websites respectively, Oracle's performance advantages when comparing its Autonomous Database on Exadata Cloud@Customer with Amazon's RDS on AWS Outposts are certainly impressive. To quantify this, Oracle can operate at up to 98% *less latency* (1-19 microseconds compared to 1000)*,* provide 12 time *more IOPS* (12M versus 960k) and 10 times *more throughput* (330 GB/sec compared to 28.5 GB/sec), and support databases more than 7 *times larger* (476 terabytes[12] compared to 64 terabytes).

- **Leverages the cloud subscription economic model.** Organizations pay as they go (there are no start-up capital costs, but there is a minimum commitment of three years, and monthly costs can be as low as $10,800) and scale, automatically, as needed (Oracle provides infrastructure capacity planning as part of the service). This enables organizations to scale for end of month, quarter, or year activities without continually paying for unused capacity through the whole year.

- **Offers completely autonomous management.** The on-premises services are self-driving, -provisioning, -configuring, -securing, -repairing, -patching, -backing up, -recovering, etc. : and they leverage the same AI/ML that's powered Oracle's public cloud offering for the last several years. An Oracle PowerPoint[13] slide sums up the required human element for its Autonomous Database under the no-doubt appealing mantra of "Nothing to learn – Nothing to do." Automated patching removes manual labor and eliminates manual error. Customers get a higher level of security as the machines do the patching—they don't need a sick day and never fall asleep behind the wheel.

- **Enables IT to focus on innovation**. It frees IT teams from both database and infrastructure management and monitoring chores (where automating lifecycle management tasks like patching, backups and upgrades can reduce errors and minimize downtime). Meantime, DBAs can focus more on accelerating DevOps processes and rapidly connecting applications to secure, on-premises databases.

- **Is inherently more secure**. In addition to prebuilt end-to-end security policies and templates, Autonomous Database constantly scans for anomalous activity, using AI/ML technologies to thwart external or internal threats. And, of course, it runs behind customers' firewalls in their data centers, meaning it also meets whatever general level of system and physical security each user is comfortable with. Yes, there is public cloud UI and management but the link into the customer data center is via a secure tunnel and no user data—or even metadata—ever leaves the user's embrace unless they specifically want it to. In addition, Oracle employees who manage the infrastructure have no visibility into the data.

In officially announcing the product on July 8th 2020, Larry Ellison was keen to mention all the above, and emphasize its serverless nature, its ease of installation, and the commonality of the management console for cloud and on-premises deployments. And he mentioned early adopter customers, including Samsung SDS, which already has a massive Oracle Database estate running on 300 Exadata systems and has now added Exadata Cloud@Customer with Autonomous Database for the next step on its enterprise cloud journey.

The Bigger Truth

Organizations are aggressively pursuing digital transformation initiatives to become more operationally efficient and deliver better user experiences (both internal and external). To accomplish this, many are leveraging public cloud services

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https://aws.amazon.com/ebs/features/#:~:text=Provisioned%20IOPS%20SSD%20(io1)%20volumes&text=To%20maximize%20the%20benefit%20of performance%2099.9%25%20of%20the%20time, https://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Concepts.DBInstanceClass.html
[12] Oracle has stated that it will offer even higher capacity "in the near future."
[13] Shown in the Oracle Live announcement event, July 8, 2020.

and technology to some degree. *However*, not every organization can take advantage of the public cloud due to data security, preference, compliance, or regulatory reasons. As a result, these organizations are still deploying largely multi-vendor DIY infrastructures managed with complex manual processes, a mix that hinders progress against their digital transformation objectives. These organizations would benefit from the same proven performance, agility, subscription service, and managed cloud environments, but delivered in their own data centers. This is especially true for mission-critical tier-one applications, as organizations can't afford trial and error on watered-down cloud platforms and databases or unproven solutions to power their business.

That is precisely why Oracle is delivering its Oracle Autonomous Database as a fully featured and self-managed on-premises service that leverages the exact same Oracle public cloud infrastructure—the Oracle Exadata Cloud@Customer based on X8M—to power it. By taking this step, Oracle enables organizations to accelerate their adoption of a fully on-premises or hybrid cloud without compromising one iota in terms of capabilities or performance. In a nutshell, organizations can enjoy the benefit of the thoroughly tested, proven, and supported Autonomous Database in their own data center.

This offering significantly extends Oracle's commitment to cloud…but "cloud" as an overall IT approach rather than just a singular place or style. It also extends Oracle's commitment to its Database, by making it easier to consume and use in pretty much any place and manner that a user wants. The action is part of Oracle's growing contemporary relevance, allowing its marketing team to increasingly—and legitimately—use a lexicon of "easy, proven, best-of-both-worlds, economic, one-throat-to-choke," and the like. It allows Oracle to continue and extend its intriguing play—not fighting, but instead fully embracing, cloud, and not embracing, but strongly fighting, competitive cloud databases.[14]

Clearly this introduction keeps Oracle front and center of the on-premises-cloud-service-landscape. By essentially building and delivering replicas of its unique, flagship autonomous public cloud as an on-premises and on-demand service for global enterprises, Oracle has thrown down a highly impressive gauntlet…though if history is any guide to the future, this won't be its last innovation in this area.

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[14] This paragraph is adapted from the author's blog, *Oracle Announces Extended Autonomy & Dedicated Regions*, on this topic posted on esg-global.com on July 9, 2020.

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