Oracle Autonomous Database Strategy

Next Generation Mission-Critical Data Management in the Cloud.

ORACLE®

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IT leaders must modernize enterprise computing to the cloud and do more with less. The migration must improve protection from cyber-attacks without threatening the stability and availability of mission-critical workloads. To truly deliver transformational change, the cloud platform must include both existing and new applications. Public cloud is a key component of the transformation but migrating the entire estate to the public cloud is usually not realistic. Cost savings and agility improvements must be achieved immediately, not decades later. Oracle's Autonomous Database uniquely enables this transformation.

Oracle Autonomous Database combines the flexibility of cloud with the power of machine learning to deliver data management as a service. It enables businesses to:

• Safely run mission-critical workloads using the most secure, available, performant, and proven platform - Oracle Database on Exadata

• Migrate both new and existing OLTP or Analytics applications

• Deploy in both the Oracle Public Cloud and on Cloud at Customer in their own data centers, providing the easiest and safest cloud migration and hybrid cloud enablement

• Cut administration costs up to 80% with full automation of operations and tuning

• Cut runtime costs up to 90% by billing only for resources needed at any given time

• Protect themselves from cyber-attacks and rogue employees by automatically encrypting all data and automatically applying any needed security updates online

- Guarantee 99.995%[1] uptime to ensure mission-critical applications are always available. Downtime is limited to under 2.5 minutes per month, including maintenance

This document describes Oracle Autonomous Database strategy and roadmap. Some of the features and functionality discussed may not appear in the initial release of the service.

THE NEAR IMPOSSIBLE TASK OF MANAGING A DIGITAL BUSINESS BY HAND

IT leaders are caught in a seemingly impossible situation, as the business demands more real-time data and more agility while IT budgets stay flat. They are facing multiple daunting challenges:

- **Transforming their existing estate to a Cloud-Computing model to do more with less and be more agile.** It is relatively straightforward to develop NEW applications using a cloud model but using cloud computing only for new applications will not achieve transformational results. To achieve substantial cost savings and faster development, both existing and new applications must be moved to a cloud-computing model. Top management is demanding tangible financial results from this transformation in months, not decades.

- **Attacks from hostile nation-states from the outside and rogue employees from the inside.** Cyber security is an arms race. Historically, attacks came from lone-wolf hackers. Now companies have to defend themselves against ultra-sophisticated nation states and large criminal gangs. A collection of products that were custom-assembled over decades is going to be difficult, if not impossible, to secure against such attackers. Even elite enterprise security teams are severely challenged by the intensity and ingenuity of today's attacks. To survive, IT must enlist sophisticated partners, and adopt technologies that inherently deliver much higher levels of security than in the past.

- **Mission-critical systems in the cloud must deliver guaranteed uptime.** Downtime for critical applications causes severe financial and reputational damage. IT leaders must be sure that the cloud architecture they adopt handles every threat to availability, from software and hardware failures and maintenance to natural disasters.

IT LEADERS NEED A NEW APPROACH TO DATA MANAGEMENT ITSELF

Incremental changes around the edges aren't enough to answer these challenges. Even moving the entire enterprise computing estate to the Cloud is only a partial solution because this just shifts many of the same management difficulties to a different infrastructure.

Instead, IT leaders need to strike at the heart of the matter – a reinvention of data management for a cloud-native world. They need data management that can manage on its own the core activities of performance, security, and availability. This new approach to data management has to make data appear as if it were

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[1] The Oracle Autonomous Database architecture is designed to deliver an uptime SLA of 99.995%. As new cloud services based on this architecture become available, Oracle will guarantee this SLA

stored in a shape and made available at a scale ideal for the current workload, without having to predict it ahead of time. To deliver data management as a service like this, IT leaders need a new kind of database.

THE ORACLE AUTONOMOUS DATABASE

Like an autonomous car, the Oracle Autonomous Database (Autonomous Database) provides a level of performance and reliability manually managed databases can't deliver. Compared to a manually managed database, the Autonomous Database costs less to run, performs better, is more available, and eliminates human error.

Self-Driving

You tell the Autonomous Database the service level to achieve, and it handles the rest. The Autonomous Database eliminates human labor to provision, secure, monitor, backup, recover, troubleshoot, and tune databases. This greatly reduces database maintenance tasks, reducing costs and freeing scarce administrator resources to work on higher value tasks.

Since the Autonomous Database is based on the extremely feature rich and proven Oracle Database, on the Exadata platform, it is able to run both OLTP and analytic workloads up to 100X faster. It includes many performance enhancing Exadata features such as smart flash cache, automatic columnar format in flash cache, smart scan, Exafusion communication over the super-fast InfiniBand network, and automatic storage indexes.

In addition, when it comes time to upgrade or patch, the Autonomous Database can replay the real production workload on a test database to make sure the upgrade does not have any unexpected side effects on a mission-critical system.

Autonomous database automatically tunes itself using Machine Learning algorithms including automatically creating any indexes needed to accelerate applications. Users get the ultimate simplicity of a "load and go" architecture in which they can simply load their data and run SQL without worrying about creating and tuning their database access structures.

Self-Securing

The Autonomous Database is more secure than a manually operated database because it protects itself rather than having to wait for an available administrator. This applies to defenses against both external and internal attacks.

Security patches are automatically applied every quarter. This is much sooner than most manually operated Oracle databases, narrowing an unnecessary window of vulnerability. Patching can also occur off-cycle if a zero-day exploit is discovered. By applying patches in a rolling fashion across the nodes of a cluster, the Autonomous Database secures itself without application downtime.

Patching is just part of the picture. The database also protects itself with always-on encryption. Customers can control their own keys to further improve security.

In the future, Oracle's Data Masking and Redaction technologies will be used to safeguard sensitive data by concealing it for some users or workloads and masking it on test databases.

Self-Repairing

The Autonomous Database is more reliable than a manually operated database. At startup, it automatically establishes a triple-mirrored scale-out configuration in one regional cloud datacenter, with an optional full standby copy in another region. The Autonomous Database automatically recovers from any physical failures

whether at the server or datacenter level. It has the ability to rewind data to a point in time in the past to back out user errors. By applying software updates in a rolling fashion across nodes of the cluster, it keeps the application online during updates of the database, clusterware, OS, VM, hypervisor, or firmware.

If the database detects an impending error, it gathers statistics and feeds them to AI diagnostics to determine the root cause. As a final safety net, the Autonomous Database runs nightly backups for you.

In the future, when it is time to update the Autonomous Database, it will be possible to replay the full production workload on a parallel testing environment to verify the safety of the update before it is applied to a mission-critical environment.

Oracle will offer a 99.995% uptime guarantee for the Autonomous Database. Oracle understands that mission-critical systems run 24x7. Unlike other cloud vendors, Oracle provides an uptime guarantee that includes planned maintenance and all other common sources of downtime in its calculations.

Optimized for Different Workloads

Modern automobiles are specialized by workload: family car, van, pickup truck, sports car, etc. In the same way, the Autonomous Database consists of a single set of technologies available in multiple products, each tailored to a different workload:

Data Warehousing. The Oracle Autonomous Database for Data Warehousing is the simplest and most efficient database for data marts, reporting databases, and data warehousing. Available January 2018.

OLTP and mixed workloads. The Oracle Autonomous Database for OLTP is designed to run mission-critical enterprise applications, including mixed workloads and real-time analytics, with no compromise on app performance. Coming in 2018.

In the future, Oracle will also bring the autonomous principles of self-driving, self-securing, self-repairing to other kinds of databases:

- **NoSQL.** Delivers transactional operations on JSON documents and key-value data. Available in 2018.
- **Graph.** Automatically creates graph representations from tabular and JSON data for discovery of new connections through network analysis. Coming in 2018.

In addition, the Autonomous Database provides IT leaders with a cloud-native enterprise-class foundation for new app and data science development.

- **Increase app developer productivity.** The Autonomous Database instantly provides app developers with a platform that offers the variety of data management methods their apps require with the simplicity of a self-managing database. App developers simply push a button to provision a mission critical capable database.
- **Simplify data science experimentation.** Data science, like all science, boils down to experimentation. The Autonomous Database's built-in machine learning capabilities along with its self-driving and self-securing capabilities, makes it easy for data science teams to experiment with datasets that are otherwise locked away in operational silos for performance or security reasons.

EASY AND FAST TRANSITION TO THE CLOUD

For IT leaders who want to move enterprise IT to a cloud foundation, the Autonomous Database offers the smoothest and easiest transition.

- **Oracle Public Cloud, Cloud at Customer, or both.** The Autonomous Database runs in both the Oracle Public Cloud and Cloud at Customer environments. This means IT leaders can have the management ease and subscription pricing of cloud for all enterprise workloads, including those that must stay in-house for regulatory, data sovereignty, or network latency reasons.

- **Go cloud-native without app changes.** Because the Autonomous Database is still an Oracle database, existing apps can be quickly and easily moved to this new cloud-native data management platform with no app changes.

With Autonomous Database, major cost savings and agility improvements come quickly, not after years to decades of application rewrites.

SAFEST TRANSITION TO THE CLOUD

The transition to the cloud must improve the availability of mission-critical workloads, not put them at risk.

The Autonomous Database is built on top of the most widely proven and sophisticated database in the world: Oracle Database. The Oracle Database is capable of running any type of workload in a highly secure, available, and scalable fashion.

The Autonomous Database runs on the best database platform in the world: Exadata. Exadata is a cloud-architected scale-out platform that uses the latest technologies including NVMe flash and InfiniBand networking, together with unique database optimizations in storage, compute, and networking to deliver leading performance, scaling, and availability, at the lowest cost.

Oracle's long experience and track record ensures that the transition to the cloud is safe and smooth. The largest enterprises and governments in the world already run all types of mission-critical workloads with Oracle Database on Exadata including:

- Multi-petabyte warehouses
- Ultra-critical applications like financial trading of trillions of dollars daily
- Highly sophisticated and complex business applications like SAP, Oracle Fusion Apps, Salesforce, etc.
- Massive enterprise database consolidations to reduce the cost of fragmented database deployments

DO MUCH MORE, WITH FAR LESS

Administering a mission-critical database is traditionally very expensive because it requires manual provisioning, securing, monitoring, patching, backing-up, upgrading, recovering, troubleshooting, testing, and tuning of a complex highly available scale-out deployment with disaster recovery protection. The extensive automation provided by Autonomous Database dramatically simplifies these tasks, reducing administration costs up to 80%.

Traditional database deployments need to provision for the peak possible workload and add a substantial margin of safety on top of that. But peak workloads tend to occur infrequently, leaving most of this costly capacity idle the majority of the time. Oracle's Universal Credits subscription model for cloud deployments allows customers to pay for just the resources they use. Autonomous Database allows elastic adjustment of compute and storage resources so that only the required resources are provisioned at any given time, decreasing runtime costs by up to 90%.

New application development often suffers from many months of delays waiting for database provisioning, testing, and tuning. With Autonomous Database, new applications don't wait at all, saving tens of thousands of dollars per application and enabling much faster innovation.

The Autonomous Database subscription includes many management, testing, and security capabilities that previously had to be licensed separately, including:

- Data Encryption

- Diagnostics Pack
- Tuning Pack
- Real Application Testing
- Data Masking, Redaction and Subsetting
- Hybrid Columnar Compression
- Database Vault
- Database In-Memory (subset) – in Autonomous Data Warehouse
- Advanced Analytics (subset) - in Autonomous Data Warehouse

To implement full data management workflows, other clouds use a combination of multiple specialized databases such as a queuing database, OLTP database, JSON data store, reporting database, analytics database, etc. Each database is independently developed and therefore has its own data model, security model, execution model, monitoring model, tuning model, consistency model, query language, analytics, etc. Data needs to be transformed and copied between these specialized databases. While moving data between specialized databases can make sense for some extreme high-end applications, **it adds enormous unnecessary cost and complexity** to the large majority of applications. Furthermore, it severely compromises security since protection is limited by the worst

system in the workflow. The Autonomous Database handles all these functions in a single database with no need for complex data movement and provides integrated analytics across all data types.

CONCLUSION

IT leaders face the imperative to transform to cloud *and* do more with less. The Oracle Autonomous Database is the only solution that enables IT leaders to transform both new applications and their existing estate in a safe and effective fashion.

With Oracle Autonomous Database, customers uniquely get the world's leading database, Oracle Database on the best platform, Exadata. This combination provides the most secure, available, performant, proven solution at the lowest cost as all operational tasks are fully automated and customers only pay for resources they use with Universal credits or Bring Your Own License. The Autonomous Database's fault-tolerant scale-out cluster that works transparently for both OLTP and Analytic workloads makes it uniquely capable of running Mission Critical workloads.

Autonomous Database is also the safest cloud deployment because data is automatically encrypted, and security updates are automatically applied as soon as they are available. It guarantees 99.995% uptime, including planned maintenance activities. It has the simplest, quickest, and safest migration with fastest time-to-value because customers can easily migrate their existing databases to Autonomous Database in either the Public Cloud or Cloud at Customer environments without needing to make any changes to their applications.

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