Oracle Autonomous Database Technical
Available in the Cloud or on-premises, Oracle Autonomous
Database is self-driving, self-securing, and self-repairing.

ORACLE

OVERVIEW

Oracle Autonomous Database combines the flexibility of cloud with the power of machine learning to deliver data management as a service. It's built upon a foundation of technical innovations that have been developed by Oracle over the course of more than three decades, meeting the needs of thousands of enterprise customers worldwide. The foundation for Autonomous Database includes:

- Oracle Database Enterprise Edition
- Exadata Database Machine
- Oracle Cloud Infrastructure
- Oracle's Best Practices
- Oracle's Knowledge Base
- Machine Learning

Autonomous Database incorporates all of these technologies to deliver a database that is self-driving, self-securing, and self-repairing, allowing customers to focus energies on developing and delivering solutions that directly add value to their business. Each of these technologies provide powerful capabilities separately, but in combination these technologies deliver the revolutionary Oracle Autonomous Database.

Key Points

Exadata Database Machine

Exadata was introduced in 2008. Exadata is more than computer hardware with pre-installed Oracle database software. Exadata is the synthesis of software and hardware, where critical database functions are distributed across the hardware components. Other modern hardware platforms still follow a conventional compute + storage system architecture that does not operate in the same manner. Exadata storage does not simply store and retrieve blocks of data. The core database engine offloads critical functions to the Exadata storage to execute those functions with minimal movement of data. These offloaded functions include a wide range of critical operations, from filtering for changed blocks during incremental backup, to execution of SQL (Structured Query Language) fragments during parallel analytic operations. Exadata also provides Remote Direct Memory Access to greatly accelerate SQL on scale-out clusters.

Oracle Cloud Infrastructure

Oracle Autonomous Database simply would not have been possible without the Oracle Cloud and a new generation of software-defined Infrastructure as a Service. The Oracle Cloud is architected for the full range of applications and databases, from small scale to enterprise-class applications requiring high performance and scalability. Oracle has thousands of customers running mission-critical systems that continue to push the bounds of computing technology. Oracle customers have workloads that exceed the capabilities of the largest computers available on the market, and only the Oracle database is able to address those needs through its clustering technology, Real Application Clusters. Oracle's Cloud infrastructure is designed with these needs in mind to deliver unmatched performance, security, and availability in the Cloud.

Oracle Best Practices

Oracle publishes "best practice" recommendations for deployment, configuration, and operations of products such as the Oracle Database and Exadata. These "best practice" recommendations evolve along with the evolution of underlying infrastructure components and the Oracle Database. Oracle's Database development team are the leading experts in Oracle technology and are the same team who have developed the Autonomous Database. Oracle works with customers worldwide to define best practices for using Oracle technology to achieve the **highest availability, security, and performance and have implemented those same best practices in the Autonomous Database.**

AUTONOMOUS DATABASE SERVICES

The underlying converged database capabilities of the Oracle Database enable the Autonomous Database to be offered in two editions that are specifically tailored to a workload following Oracle's Best Practice recommendations. Oracle Autonomous Data Warehouse (ADW) is tailored to Data Warehousing, Data Marts, Data Lakes, and Machine Learning workloads. Oracle Autonomous Transaction Processing (ATP) is tailored to On-Line Transaction Processing, Batch, reporting, IoT, application development, machine learning, and mixed workload environments.
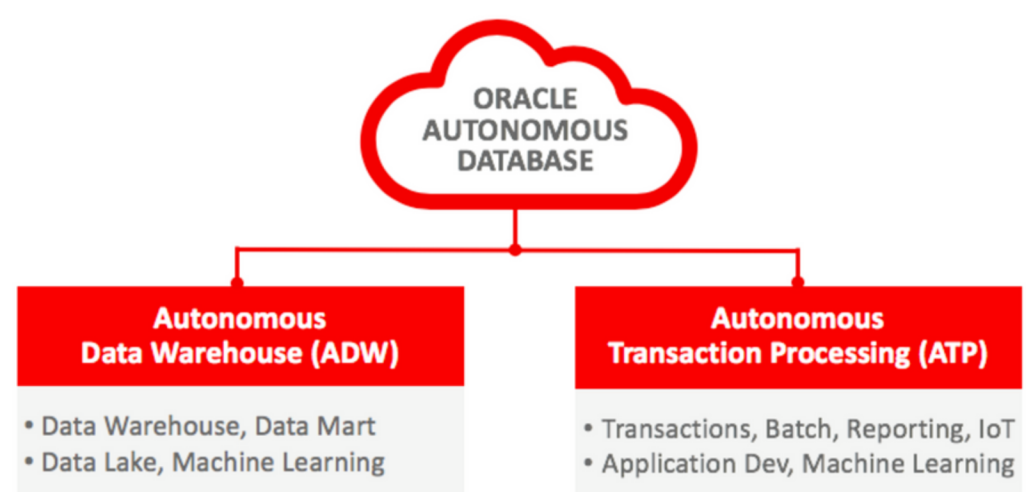
Autonomous Data Warehouse

As the name implies, Oracle Autonomous Data Warehouse (ADW) is tailored for Data Warehouse and related workloads including Data Marts, Machine Learning or as part of a Data Lake deployment. These systems and databases are generally separated from Transaction Processing applications and are constructed to meet specific business needs. Data Warehouses often use data modeling approaches such as Star Schema and other techniques to ensure data structures meet the needs of business users conducting data analysis, and Data Scientists performing trend-analysis. Data Warehouses typically house large volumes of data that is processed in bulk or streamed into the database. Data Warehouses often rely on summary data representation and highly parallel SQL to provide fast response times. Oracle Autonomous Data Warehouse is tailored specifically to these use-cases.

Dedicated

With Dedicated Infrastructure, customers have their own dedicated Exadata infrastructure in the Oracle Cloud, effectively giving them a Private Database Cloud within the Oracle Public Cloud. Oracle Autonomous Database on Dedicated Infrastructure runs inside a hardware enforced virtual cloud network, offering the highest level of isolation from other tenants. Users can easily configure one or more Container Databases on their dedicated Infrastructure, each of which can contain one or more Pluggable Databases.

Dedicated Infrastructure gives customer the opportunity to customize the Operational Policies used to control the provisioning of new database, the timing of updates, the availability, and the density of databases that they run on the infrastructure. Having control over database versions and the timing of upgrades is especially important for applications that are more sensitive to database version and release differences. Although customers can customize these Operational Policies, all operations are still fully automated by Oracle.

With Dedicated Infrastructure customers have the ability to define "fleet administrators" who manage the overall service, as well as individuals who can deploy and manage the databases themselves. It is an ideal platform for customers who are looking to rethink their IT strategy and move some or all of their database estate to a Cloud based solution.

Autonomous Database on Exadata Cloud@Customer

Some organizations are not able to deploy databases in the Public Cloud even when deployed on dedicated infrastructure in the Public Cloud. For this reason, Oracle Autonomous Database can also be deployed in a customer's data center (or 3rd party outsourcing site) on dedicated infrastructure in the Cloud@Customer model. The most common reasons for using the Cloud@Customer model include:

- Regulations
- Latency
- Integration
- Risk

Many companies cannot easily move to public cloud due to challenges involving the regulatory nature of their data, data sovereignty laws requiring data to stay in country of origin, and the complexities of systems entanglement present in enterprise architectures. Systems entanglement happens because individual applications are coupled to others in such a way that changes to one impact the others, thereby complicating a move to public cloud. To mitigate these challenges while providing customers the benefits of cloud self-service and a pay-per-use financial model, Oracle introduced Exadata Cloud@Customer in 2017, bringing the cloud to customers who cannot simply transform to public cloud. Autonomous Database on Exadata Cloud@Customer (or on Dedicated Regions) delivers all the value of Autonomous Database to the customer's data center.

With Autonomous Database on Exadata Cloud@Customer, customers get the full advantage of Autonomous Database combined with the benefits of dedicated infrastructure in their own data center. More information on Oracle Autonomous Database and Exadata Cloud@Customer can be found at the following

SECURITY

Information Security has become an even more critical topic in recent years due to increases in cyber security threats and breaches. Autonomous Database is built upon the foundation of the Oracle Cloud Infrastructure, which is an enterprise-grade Cloud service, delivering the highest possible security standards in the industry.

All data stored in and network communication with Oracle Cloud are encrypted by default. Autonomous Database builds upon this secure foundation through the following:

- Best Practice Security Configuration
- Automatic Security Updates
- Database Encryption
- Network Security Monitoring
- Encryption Key Management
- Oracle Database User Security
- Database User Password Controls
- Auditing Database Access
- Administrator Data Access Control
- Database Vault

Best Practice Security Configuration

Systems running Autonomous Database are secured using best practices for security at each level, including Virtual Machines, O/S, drivers, Exadata storage, Oracle Cluster ware, Real Application Clusters, and Oracle Database. Autonomous Databases are continually scanned to ensure compliance with current best practice security configuration. If anomalies are detected, changes are automatically implemented without customer intervention. Autonomous Database also includes Oracle Data Safe, which provides comprehensive tools to ensure data security,

DATA PROTECTION

Data protection is automatically configured once an Autonomous Database is created. Oracle Autonomous Database provides robust data protection due to the underlying architecture based on Exadata, as well as Oracle database backup/recovery capabilities.

Autonomous Database follows the principal of defense in depth, starting with the system configuration and following industry leading best practices for data protection, including Oracle Maximum Availability Architecture (MAA). The overall data protection scheme includes the following components:

- Redundancy & Resiliency
- Standard Database Backups
- Supplemental Database Backups
- Database Recovery
- High Availability

Redundancy & Resiliency – High Availability

Autonomous Database includes all of the built-in redundancy and resiliency features that are part of the underlying Exadata platform. Autonomous Database uses a high availability (HA) configuration as a non-optional, default configuration. Autonomous Database extends these HA capabilities to the application tier using Oracle Application Continuity. This high availability configuration of Autonomous Database allows application developers and users to focus on business requirements.

OPTIMIZATION

Optimization of a database refers to making optimal use of the resources assigned to that database. Administrators must determine the amount of resources assigned to a particular database and evaluate resource allocations on an ongoing basis. Database optimization in an Oracle database occurs at 3 levels, including service, system, and application schema level as outlined in this section.

AUTONOMOUS DATABASE ADMINISTRATION

Autonomous Database brings an unprecedented level of automation to the operation of Oracle databases. Customers are able to exercise a degree of control over the service where required, with controls that are greatly simplified in comparison to legacy systems or other 3rd party Cloud services. In this and the following sections, we will explore what administrative functions are automated and what controls customers have over the service. Finally, we will also touch upon the tools available for monitoring and managing an Autonomous Database.

Automated Administrative Functions

Autonomous Database automates virtually all administrative functions for Oracle databases that normally consume a great deal of time and effort by Database Administrators, System Administrators, and other IT Professionals. Autonomous Database provides the following set of core automation capabilities that will be explored in greater detail in subsequent sections of this document:

- Provisioning
- Scaling
- Management
- Security
- Data Protection
- Optimization

Oracle SQL Developer

The Oracle SQL Developer tool is widely used by Oracle database administrators and application developers for working with Oracle databases and is fully compatible with Autonomous Database. SQL Developer includes the following User Interfaces:

- Graphical User Interface (Windows, Mac OS, Linux, etc.)
- Command Line Interface
- SQL Developer Web

Performance Analysis Tools

Autonomous Database includes automatic (real-time) statistics, automatic indexing, and automatic SQL plan management, relieving developers and DBAs from common and tedious performance tuning.

It also gives developers and DBAs access to the same in-depth performance analysis tools found in Oracle Database to provide insight into performance of SQL and applications using Autonomous Database. These tools can be used to evaluate the effectiveness of a give database schema and functional correctness of SQL. Autonomous Database performance analysis tools also include the following:

- Cloud User Interface
- Performance Hub
- Oracle Automatic Workload Repository (AWR)
- SQL Monitor

MIGRATION CONSIDERATIONS

Oracle Autonomous Database is ideal for new application development approaches such as the microservices architecture. Oracle Autonomous Database is easy to deploy and requires virtually no administration aside from the necessary level of control outlined in this document. Oracle Autonomous Database is also an excellent platform for hosting existing applications and provides an opportunity to adopt best practice recommendations as part of the migration process.

Oracle customers, partners, and independent software vendors need to be aware of several considerations related to migration to Oracle Autonomous Database. These topics are covered in more detail in Oracle Autonomous Database documentation.

CONCLUSION

Oracle's Autonomous Database is available in the Oracle public Cloud as well as on-premises in customer data centers for customers who cannot move to the public Cloud. Oracle Autonomous Database automates virtually all Operations DBA functions, allowing customers to focus on building and deploying applications that more effectively meet business requirements. Automation layers in the Oracle Cloud automatically detect and correct issues much faster and more accurately than even the most seasoned professional can accomplish using traditional manual methods. Oracle Autonomous Database is built on the Oracle Cloud Infrastructure, which keeps systems constantly updated with the latest fixes and security patches, giving developers immediate access to the latest innovations in the Oracle database. Autonomous Database is built on Oracle's Exadata Database Machine which delivers the high performance and cost- effective operation customers require for their most demanding and mission-critical applications.

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