Oracle Autonomous Database

for dummies®
A Wiley Brand

Discover the business value of autonomous

—

Explore customer success stories and use cases

—

Gain new insights from data faster

Lawrence Miller, CISSP

3rd Special Edition

About Oracle Cloud

Oracle Cloud is the industry's broadest and most integrated public cloud, offering a complete range of services across SaaS, PaaS, and IaaS. It supports new cloud environments, existing ones, and hybrid, and all workloads, developers, and data. Oracle Cloud delivers nearly 1,000 SaaS applications and 65+ enterprise-class PaaS and IaaS services to customers in more than 195 countries around the world and supports 55 billion transactions each day.

For more information, please visit us at **https://www.oracle.com/cloud**

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Oracle Autonomous Database

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by Lawrence Miller

Oracle Autonomous Database For Dummies®, 3rd Special Edition

Publisher's Acknowledgments

Introduction

Automation is everywhere today — from smart homes and appliances to semi-autonomous cars and more. But the real opportunity of automation and autonomous technologies, including other advanced technologies such as artificial intelligence (AI), machine learning, the Internet of Things (IoT), and human interfaces, is to enable us to embrace innovation on a scale never before seen. These technologies help us reimagine what's possible in work and in life — from fully autonomous, self-driving cars and personalized medicine to precision agriculture and smart cities that are changing the way we experience our world.

Autonomous opens a new world of opportunities for enterprises. It allows them to move from operations to innovation. It enables new ways to develop and deliver apps and services. Enterprises can harness the abundance of data to gain predictive insights into their businesses and ultimately drive better outcomes for their customers. They can see the signals sooner and adapt faster. And finally, they can run their organizations smarter, more efficiently, and more securely through automation.

About This Book

Oracle Autonomous Database For Dummies consists of five chapters that

>> Describe emerging technology trends and the business value of autonomous (Chapter 1)

>> Explore the Oracle Cloud Infrastructure (Chapter 2)

>> Introduce Oracle's Autonomous Database services — Oracle Autonomous Data Warehouse, Oracle Autonomous Transaction Processing and Oracle Autonomous JSON (JavaScript Object Notation) Database (Chapter 3)

>> Examine Autonomous Database use cases and real-world successes (Chapter 4)

>> Outline why you should choose Oracle Autonomous Database for your enterprise (Chapter 5)

Foolish Assumptions

It has been said that most assumptions have out-lived their uselessness, but I assume a few things nonetheless!

I assume you work as a line of business (LOB) manager, a business analyst, a senior information technology (IT) manager, a database developer or administrator, or in a similar role and you're looking for database solutions to help your enterprise leverage emerging technologies and automation to unlock new opportunities.

I also assume that you have at least some familiarity with cloud and database technologies but you aren't necessarily a technical reader. As such, this book isn't overly technical and doesn't require an in-depth knowledge of programming languages or science-fiction/fantasy movies — I even spell out the techie acronyms for you!

If these assumptions describe you, then this book is for you.

Icons Used in This Book

Throughout this book, I occasionally use icons to call out important information. Here's what to expect.

This icon points out information you should commit to your nonvolatile memory, your gray matter, or your noggin!

REMEMBER

If you seek to attain the seventh level of NERD-vana, perk up! This icon explains the jargon beneath the jargon!

TECHNICAL STUFF

Tips are always appreciated, never expected — and I sure hope you'll appreciate these tips. This icon points out useful nuggets of information.

Beyond the Book

Although this book is chock-full of information, if you find yourself at the end of this book thinking where can I learn more, just go to `www.oracle.com/database/autonomous-database`.

Chapter **1**

Why Autonomous?

I n this chapter, you find out how autonomous database technologies benefit businesses today and how emerging technology trends are driving new opportunities and challenges.

Recognizing the Business Value of Autonomous

As customer data grows exponentially, businesses are challenged with the task of managing all that data while constantly trying to analyze and derive insights to improve the experience for their customers. This is putting increased pressure on IT as they struggle to secure, monitor, and manage the data while making it accessible in real time for the business. The increasing volume, velocity, and variety of the data only adds to this complexity, and ever-shrinking IT budgets makes their job harder.

It is impossible to manage all this data manually and use it for competitive advantage with the resources and budget currently available to organizations. It is also not feasible to throw in more resources at the pace and size required. The only option is to make the systems do more: Manage all this data automatically, ensure it's always available, and keep it secure.

Hence the need for autonomous systems that automate all the management tasks, reduce the need for human intervention, and eliminate human errors, thus requiring fewer resources and reducing costs.

Autonomous self-service capabilities provide quick access to data for faster insights, rapid application

development, and predictive analytics while reducing reliance on IT and associated costs.

Differentiating between Autonomous and Automated

The first thing to understand about *autonomous* is that it's not the same as *automated.* A process for database backup, failover, or resizing that can be accomplished automatically is still not autonomous if a database administrator must respond to an alert, make decisions, and click a few buttons (or type a few commands) in order to initiate the automated activity. In contrast, an autonomous database combines the dynamic agility of the cloud with the intelligent responsiveness of applied, adaptive machine learning (ML). The design goal is to make the database intelligent and self-reliant so as to minimize or eliminate human labor — and associated human error — and ensure data safety and optimal performance.

Database workloads that were deemed too large or "mission critical" to run outside corporate data centers just a few years ago now run in public clouds. In addition, capabilities such as database resource deployment, monitoring, management, cloning, replication, and recovery can also be automated, leading to greater operational efficiencies and cost savings.

Businesses will find that autonomous capabilities can further help IT staff improve efficiencies by enabling them to focus on higher-value activities in lieu of mundane, time-consuming tasks. This is significant considering that 75 percent of IT management budgets are spent on manual database management, according to the IDC Perspective report *Oracle's Autonomous Database: AI-Based Automation for Database Management and Operations.* An autonomous database can help organizations transform database operations into a modern cloud model that simplifies processes, secures all their data, lowers operating expenses, eliminates costly downtime, and ultimately enables them to innovate more while using fewer resources.

> **TIP** By 2025, Oracle predicts that 90 percent of all manual IT operations and data management tasks will be completely automated.

Understanding Emerging Technology Trends

ML and artificial intelligence (AI) are fundamentally transforming how organizations receive, manage, and secure business data.

> By 2025, Oracle predicts that 100 percent of enterprise applications will include some form of embedded AI.

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Autonomous technologies, enabled by ML and AI, are beginning to reshape how we think about — and interact with — the world around us. The opportunities that the cloud presents are real and provide the building blocks for companies to pioneer groundbreaking innovations and disrupt entire industries.

ML and AI working together with the cloud address some of the common data management challenges, such as the following:

- **Performance:** Higher revenue and user productivity gains result from ensuring the delivery of timely and compelling data to support business operations and reducing the time required to deliver new business applications. Organizations depend on their database environment to provide high-quality data in a timely manner. Oracle's Exadata infrastructure is optimized to run databases and is the best platform available, providing the highest performance and availability in the industry. Before the cloud, only large organizations were able to afford and implement Exadata. Now, with cloud services and autonomous database even small to medium businesses (SMBs) and startups can take advantage of Exadata and run smaller workloads by renting a small fraction of Exadata that they need for their workload. Autonomous Database combines Exadata performance with automated tuning and automated indexing capabilities to

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guarantee the highest performance for any workload without human intervention.

>> **Security:** As we become more connected, cyber-threats are becoming more pervasive. With a larger attack surface, new threats are becoming increasingly difficult to detect and prevent. Nation-states and organized criminals are using many of these same emerging technologies to wage cyberwarfare against enterprises for their data. Security teams at organizations of every size are struggling to keep pace with these persistent attacks.

>> **Talent/skill shortage:** There isn't enough cybersecurity talent to handle the problem. According to the International Information System Security Certification Consortium (ISC)[2] *Cybersecurity Workforce Study 2020,* there are approximately 3.1 million vacant cybersecurity jobs worldwide. Ultimately, autonomous technologies are needed to successfully address the growing threat landscape.

> Other enterprise challenges include scaling, reliability, resilience, and cost.

REMEMBER

With autonomous technologies, you can use ML to make the machines support and solve some of these challenges for you, along with cloud and other services, helping to drive innovation and real change for your business.

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Building a Foundation on Oracle Database Innovations

Oracle has spent the last 20+ years automating its database technology, starting from database version 9i and continuing to today's "cloud-first" 21c, delivering full life-cycle automation.

Oracle has delivered significant innovation in database software — from providing developers with tools to store and format their data to automating data processes such as integration and encryption. Oracle Database 12cR2 delivered new capabilities around multitenancy, in which a single instance of software runs on a server in a shared environment. This capability provides customers the flexibility to do what they need to do in public and private clouds to match business needs.

Through the evolution of their databases, Oracle has continued to apply automation across all data processes, starting with automation of basic elements such as storage and tuning to help customers achieve better operational efficiency.

Oracle has also leveraged the data collected from running databases for the last 20 years to build and test ML models that can help predict and prevent database failures and automatically optimize performance of queries on an ongoing basis. Oracle has implemented database best

practices to further improve performance and automatically configure and tune the database.

Built on Oracle Exadata's highly available architecture, Oracle Autonomous Database is available on premises via Oracle Cloud@Customer or in the Oracle Cloud Infrastructure. This flexibility enables customers to keep their data on premises while availing themselves of all the benefits of public cloud. Companies that can't move all their data to public cloud can also unlock the potential of their data like never before. Go to `www.oracle.com/database` to learn more.

Chapter **2**

Looking at Oracle Cloud Infrastructure

I n this chapter, I explain how Oracle Cloud Infrastructure (OCI) brings autonomy to your data. OCI is Oracle's infrastructure as a service (IaaS) offering that is the foundational architecture for Oracle cloud and it is the home of Oracle Autonomous Database.

Next-Generation Infrastructure

Workloads such as data warehousing, analytics, and transaction processing run best on an infrastructure designed to provide low latency, high availability, security, resiliency, and consistent performance. These are the key core tenets of OCI, which is the foundation that supports Oracle Autonomous Database. OCI, designed specifically for enterprises, delivers the powerful compute, storage, database, networking, and platform services necessary to deliver innovative business outcomes. OCI provides an architecture for enterprises to more easily move from on-premises to cloud, with built-in security to mitigate threats, as well as superior economics with improved automation. It includes industry-leading scalability and availability with autoscaling so the database can grow and shrink automatically based on workload demands. It also includes integrated governance and control, as well as reliability backed by end-to-end service-level agreements (SLAs). And OCI is built for innovation. OCI supports all the emerging technologies, including artificial intelligence (AI), machine learning (ML), Internet of Things (IoT), blockchain, and human interfaces. Additionally, it offers native support and an integrated console access to Oracle's Autonomous Data Warehouse (ADW), Autonomous Transaction Processing (ATP), and Autonomous JavaScript Object Notation (JSON) Database (AJD) services, which are all services of Autonomous

Database, discussed in depth in Chapter 3, as well as many of Oracle's Cloud services — such as Integration and Analytics, to name two. These services provide a fully integrated cloud, helping to streamline and simplify your move to the cloud.

The infrastructure is specifically architected to provide the performance predictability, security, governance, and transparency required for enterprise workloads. OCI supports traditional, crucial, performance-intensive, and high-performance computing (HPC) workloads typically found in on-premises environments, as well as cloud-native, AI, and mobile apps.

To run these workloads optimally, the database along with the underlying OCI infrastructure provide the following:

» **High availability:** OCI resiliency, high availability, and disaster recovery options include architectural deployment options across multiple fault domains, multiple availability domains (ADs), and/or multiple regions. Organizations can use OCI to support zero-data-loss architectures like Oracle's Maximum Availability Architecture (MAA), as well as scale-out architectures like Cassandra. OCI regions generally contain three ADs. These ADs are stand-alone data centers located about 19 miles (30 kilometers) from each other and connected by high-bandwidth private networking.

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» **Superior scale:** Oracle databases scale to many times the storage capacity and performance of competitors, reaching up to 340 terabytes (TB) of usable capacity and millions of input/output operations per second (IOPS) per instance. Large local nonvolatile memory express (NVMe) storage up to 512TB and block volumes reaching over 1 petabyte (PB) per instance provide the perfect environment for large data lakes.

» **Layers of resilience:** Oracle offers multiple layers of availability and protection, including unique capabilities like Oracle Real Application Clusters (RAC) for Oracle Database. Policy-based backups for object and block storage, with automatic replication of encrypted objects across multiple fault domains, provide high durability and data security, while active monitoring and self-healing ensure that data remains healthy.

» **Consistently fast connectivity:** Private Virtual Cloud Networks (VCNs) and 25 gigabit per second (Gbps) networking ensure predictable, low latency between hosts. OCI extends this concept to connectivity between ADs as well. Finally, enterprises can connect to OCI via FastConnect, which provides a dedicated, high-speed connection and overcomes the challenges typically associated with traffic running over the public Internet.

- » **Industry-first end-to-end IaaS SLAs:** To support all these claims, Oracle is the only provider to offer performance, management, and availability SLAs offering enterprises peace of mind as they consider migrating workloads to or building new applications on OCI.

- » **Security-first approach:** OCI is secure by design, with the next generation of cloud infrastructure, and is protected and managed autonomously. Organizations reduce risks from constant threats with security-first design principles that utilize built-in tenant isolation and least privilege access. Your data is isolated from Oracle and other tenants, and there is isolation between application tiers. Controls built within the application and database ecosystem leverage the hardened cloud infrastructure. Autonomous design identifies and responds to threats before they happen, without the need for human monitoring or intervention. Data errors and breaches are avoided, including malicious internal acts, because *no humans are involved;* therefore, there's no human error or human-created breach.

- » **Optimum price/performance:** OCI provides leading price/performance because workloads deployed on the platform often require fewer compute servers and block storage volumes, which lowers costs. Learn more at `www.oracle.com/cloud/economics`.

App Development with Autonomous Database

Oracle Cloud provides an open, modern, easy, and intelligent platform and infrastructure to develop, deploy, and manage applications. App development is simplified with a single converged Autonomous Database rather than stitching together numerous single-purpose databases. Developers using Oracle Cloud can use modern application development architectures, like microservices, and familiar technologies to build powerful data-driven cloud-native applications. Oracle Cloud offers developers flexibility and choice, portability, compatibility, and interoperability with other technologies, including open-source and third-party components.

Development today is often about distributed app development. Basically, this means separate teams moving at their own pace, using their own tools, languages, data models, and databases. One database per service is the norm, so with lots of services comes lots of potentially different databases. For developers this is great — it gives them the flexibility to use the language and tools of their choice and use their own choice of frameworks to build and release applications faster with self-service capabilities.

Oracle database supports all frameworks, languages, data types, and workloads. Instead of requiring different

databases for each data model (for example, see the Amazon Web Services [AWS] list of database types at https://aws.amazon.com/products/databases). Developers can fire up an Oracle instance to support their choice of JSON, Graph, key/value, relational, or other data models.

A developer using JSON might just use get/put to work with their data. But since it is a multi-model database, they can also query that JSON data with SQL or use a graph query to look for relationships with atomicity, consistency, isolation, durability (ACID) compliance. Another benefit is that if the developer needs to change data models (they would hope not to, but it does happen), they get to keep the same Oracle Database. With AWS, they have to swap databases, which is disruptive.

Many of the challenges that non-developers have with the microservices-based development model are addressed by Oracle Autonomous Database. For example, ad hoc queries, operational reporting, and creating a consistent security model are all much easier to do with Oracle Autonomous Database than with multiple specialty databases.

The Autonomous Database meets developer needs by supporting all common data models and independent database instances, and goes above and beyond to help accelerate application development with the following:

» Simple-to-change data models

» Ability to query any data with SQL

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- » Autonomous tuning, patching, and upgrading

- » Improved support for other data users

- » Simplified operational reporting, ad hoc querying, security setup, and audit

Developers can choose among the following:

- » Popular programming languages such as Java, Node.js/JavaScript, PHP, Python, Ruby, C#/.NET, and more

- » Multiple databases for any workload, including Oracle Database, SQL, NoSQL, and In-Memory

- » Multiple operating systems, such as Linux (Oracle, SUSE, Ubuntu, CentOS, Debian), Windows, and Solaris

- » Choice of infrastructure (containers, VMs, bare metal)

With Oracle, enterprises have the flexibility to run their applications in a third-party cloud, on-premises, or on Oracle Cloud, depending on their business needs. Meanwhile, developers can build modern applications using the latest technologies, architectures, and development methodologies including Kubernetes, AI/ML, blockchain, digital assistants, and more using self-service tools and Representational

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State Transfer (REST) application programming interfaces (APIs).

Oracle Integration provides intelligent automation and integration to enable you to deliver your digital modernization projects faster and easier. Through a combination of innovative ML, prebuilt integration recipes, and a powerful library of run-ready application adapters, Oracle Integration unifies your SaaS and on-premises applications, your robotic and human process automation, and your business partners into a connected business.

Oracle Integration is well suited for non-developers to rapidly connect their businesses. Oracle's customers have built integrations between key business systems in just a few days. It has enabled them to deliver powerful insights by removing data silos and integrating all their data.

SAVING TIME WITH LOW-CODE DEV

Eliminate 98 percent of hand coding with the Oracle Autonomous Database. Operating an Oracle Database means you'll already have Oracle Application Express (APEX). APEX helps developers build apps 38 times faster than Javascript frameworks. Learn more at `https://apex.oracle.com`.

Analytics

Analytics permeates every aspect of our lives. No matter what question you're asking — whether it's about employees and finances, or what customers like and dislike and how that influences their behavior — analytics gives you the answers and helps you make informed decisions. Traditionally, however, analytics was limited because data access was a painful process that was human driven and labor intensive, requiring specific skills. Oracle Analytics fundamentally changes that.

Oracle Analytics combines ML and AI with data to enhance human interactions, eliminate mundane tasks, reduce bias in analysis, and enrich your decision-making and predictive ability. Oracle Analytics automatically reveals hidden patterns and makes actionable insights more accessible by empowering everyone to use data to drive every process, direct every interaction, and inform every decision so that you can achieve the outcomes you envision.

Three primary design objectives guide Oracle's analytics cloud strategy:

>> **Expanding insights consumption:** To drive broad consumption, Oracle makes it easy for everyone to interact with information so that you can engage, analyze, and act in a way that is natural — asking questions in plain language, searching for answers,

and receiving insights as narration. Cut through information overload with relevant, personalized insights, delivered proactively to you in the context that makes the most sense.

» **Powering deeper insights:** Systems must provide autonomous capabilities that help you dig deeper into your information, explaining drivers of performance, uncovering hidden patterns, and helping you get more from your data. Use these insights to model new scenarios, make intelligent decisions, and amplify insights through collaboration and social sharing.

» **Accelerating time-to-action:** Removing constraints on time and scale is critical. You must condense the time it takes to go from raw data to insight to action. Many previous systems were designed for a limited set of use cases, and computing infrastructure was complex and costly to change. Oracle's strategy is to create one platform for a broad range of business use cases, all integrated into a common data and analytics metaphor.

Oracle Analytics changes the way information is analyzed, providing organizations with faster self-service visualization and analysis. From data visualization and scenario modeling to enterprise reporting, adaptive intelligence, and predictive analysis for answering "what if" questions, enterprises can accelerate analysis with automated

recommendations for visualizations, single-click forecasting, clustering, and voice-enabled querying.

Oracle Analytics, combined with Autonomous Database, delivers faster and deeper predictive analytics for faster business decisions on any type of data from any source.

Autonomous Database

Oracle has redefined data management with the world's first autonomous database. An autonomous database is a cloud database that uses ML to eliminate the human labor associated with database tuning, security, backups, updates, and other routine management tasks. Oracle Autonomous Database eliminates the complexity of operating and securing Oracle Database, while giving businesses the highest levels of performance, scalability, and availability.

Oracle Autonomous Database was born on three foundational elements:

- » Oracle's automated database operations

- » Oracle's rich, policy-driven optimization, implemented via ML

- » Optimization to run on Oracle's next-generation infrastructure, delivering on performance and elastic scale

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With Autonomous Database, Oracle fully manages the life cycle; this automation allows businesses to innovate more, pay less, and ensure that their data is more secure. The core attributes of Autonomous Database — self-driving, self-securing, and self-repairing — are what make it so innovative.

Oracle Autonomous Database is composed of the following three cloud services:

>> Oracle Autonomous Data Warehouse (ADW)

>> Oracle Autonomous Transaction Processing (ATP)

>> Oracle Autonomous JavaScript Object Notation (JSON) Database (AJD)

I tell you more about Oracle Autonomous Database core attributes and services in Chapter 3.

Chapter **3**

Introducing Oracle Autonomous Database Services

I n this chapter, I introduce you to Oracle Autonomous Database, which is currently offered in three cloud services optimized for specific workloads: Oracle Autonomous Data Warehouse (ADW), Oracle Autonomous

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Transaction Processing (ATP), and Oracle Autonomous JavaScript Object Notation (JSON) Database (AJD).

A Truly Automated Database Service

Like an autonomous vehicle, Oracle Autonomous Database provides a level of performance and reliability that 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 minimizes human error.

Oracle Autonomous Database's revolutionary database software is based on machine learning (ML) that dramatically transforms how companies innovate with data by simplifying processes, automating database management, boosting efficiencies, and freeing IT resources to focus on innovation and digital transformation. Oracle Cloud puts ML to work by allowing businesses to establish new IT capabilities quickly, affordably, and securely.

Oracle Autonomous Database consists of the latest Oracle database software with all the best practices automatically configured for specific workloads. It also includes database options like Oracle Real Application Clusters (RAC), Oracle Multitenant for the best performance and availability, and Oracle Database Vault and Oracle Data Safe to guarantee security for your data. The

database software runs on Exadata, which provides the best infrastructure to run a database. Exadata has been optimized over the years to offer the highest performance and reliability for database workloads. Oracle Autonomous Database runs natively on Oracle Cloud Infrastructure while delivering workload-optimized cloud services and providing a fully managed, self-driving intelligent database. This database automatically patches, tunes, monitors, and manages itself, making it easy for developers and analysts to use. Oracle cloud has built-in security to ensure no one has unauthorized access to your data — not even Oracle.

Oracle's complete and integrated cloud infrastructure includes intelligent solutions that span the software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS) layers. Oracle also extends automation into the platform, making it available for any developer to build upon. The goal is to make cloud technologies simpler to access, easier to create, and more efficient to secure, manage, and run — so you can achieve real business outcomes (see Figure 3-1). Oracle Autonomous Database helps organizations optimize their use of data, within the bounds of policy and regulation, so business leaders can make better decisions and take actions that maximize business value.

Oracle Autonomous Database is designed on three principles (described in the following sections): self-driving, self-securing, and self-repairing.
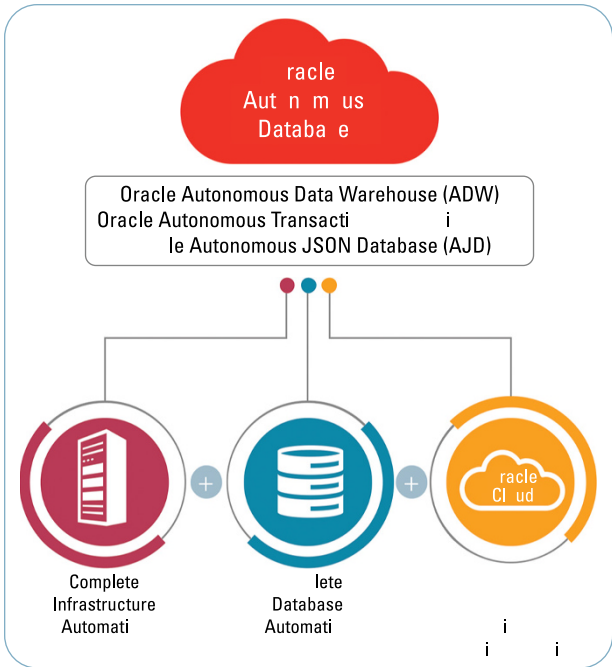
FIGURE 3-1: Oracle Autonomous Database — intelligence at every layer.

Self-driving

Tell the Autonomous Database the service level to achieve, and it handles the rest. The Autonomous Database reduces human labor to provision, secure, monitor, back

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up, recover, troubleshoot, and tune databases. This greatly reduces database maintenance tasks, reducing costs and freeing scarce administrator resources to work on higher-value tasks.

Autonomous Database is a converged database that can run any data — including relational, JavaScript Object Notation (JSON), graph, spatial, text, blockchain, and Extensible Markup Language (XML) — and any workload — including transactions, analytics, ML, Internet of Things (IoT), streaming, and multitenant — so users don't have to rely on single-purpose proprietary databases for each data type and workload. This eliminates any data integration issues, making it easier for users to access data and run analytics across all their data using the standard SQL language.

TECH

Because the Autonomous Database is based on the extremely feature-rich and proven Oracle Database, and it's running on the Oracle Exadata Database platform, it's able to run both online transaction processing (OLTP) and analytic workloads up to 100 times faster. This is because the Exadata platform provides the highest-performing and most available architecture for Oracle databases. 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 secondary

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indexes. Oracle Autonomous Database pro-
vides extreme performance and rapid time to
value.

Cloud vendors typically offer different levels of autonomy
or automation, including the following:

» Automation that you just expect from a cloud
vendor, such as provisioning, configuration, and
backups. Pretty much every vendor offers this level
of automation. It's "table stakes," but there is no
real differentiation.

» Automation that many cloud vendors do, but with
restrictions, or incomplete in some way. Examples
include encryption, updates, and patching.
Arguably, everybody expects these, but some
vendors may require downtime or human
intervention to schedule them.

» Automation that is unique to Oracle Autonomous
Database. Some examples include the following:

● Performance tuning: Significant expertise is
needed to manually do this (and redo as things
change).

● Automatic indexing: Significant expertise is also
needed to manually do this (and redo as things
change).

- Autoscaling: Some vendors have restrictions and limitations around fine granularity or cluster-level granularity, but Autonomous Database includes capabilities like transparent scale up, sharding, and parallel SQL, all of which reduce operational costs.

Self-securing

The Autonomous Database is more secure than a manually operated database because it automatically protects itself instead of having to wait for an available administrator, also reducing the risk of human error. Oracle Cloud provides continuous threat detection, while the Autonomous Database automatically applies all security updates with zero downtime; provides "always on," end-to-end encryption by default; and leverages Oracle Data Safe to help customers mitigate risk from risky users, sensitive data, and misconfigurations. Separation of duties, delineating *data* administration from *database* administration, and unified auditing are also included by default with the Autonomous Database.

Security patches are automatically applied, 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.

In addition, Oracle Data Safe helps address threat vectors like risky users, sensitive data, and misconfigurations that traditionally have been left up to customers. In turn, organizations free up scarce security resources to concentrate on more high-value efforts like enabling digital transformation, mitigating application vulnerabilities, and remediating access anomalies.

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 data center, with an optional full standby copy in another region. The Autonomous Database automatically recovers from any physical failures whether at the server level or the data center level. It has the capability 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, operating system (OS), virtual machine (VM), hypervisor, or firmware.

If the database detects an impending error, it gathers statistics and feeds them to artificial intelligence (AI) diagnostics to determine the root cause. It also provides application continuity so your application is always available without writing any extra application code. Oracle infrastructure and Autonomous Database are both

designed to deliver 99.995 percent availability including planned maintenance, so customers are assured that they can run their businesses uninterrupted. As a final safety net, the Autonomous Database runs nightly backups for you.

Oracle Autonomous Data Warehouse (ADW)

The velocity and volume of incoming data is placing crushing demands on traditional data marts, enterprise data warehouses, and analytic systems. Many organizations are proving the value of data warehouses in the cloud through "sandbox" environments, line-of-business data marts, and database backups. More advanced monetization use cases include high-performance data management projects, data warehouses coupled with cloud computing analytics, and big data cloud implementations (see Figure 3-2).

Oracle ADW is the industry's first solution for delivering data warehousing with unmatched reliability and ease. This fully autonomous database cloud service is ideal for customers to store any type of data (structured or semi-structured) and unleash the potential of data by running analytics on all their data. ADW uses adaptive ML to deliver unprecedented simplicity, performance, and highly elastic data management that enables data

warehouse deployment in seconds. ADW is self-tuning, preconfigured for automated patching and upgrades, and limits manual error-prone human management processing.
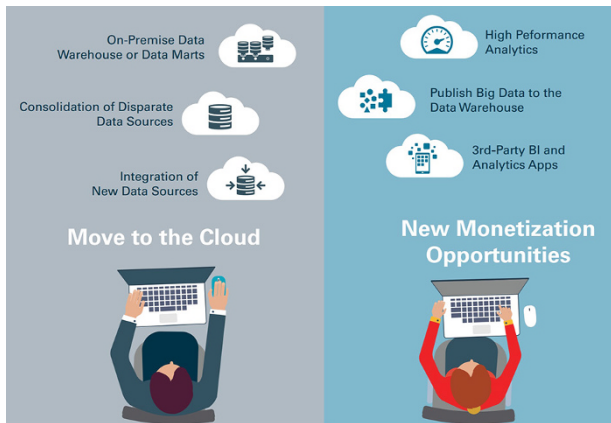
FIGURE 3-2: Common use cases enabled by Oracle ADW.

Oracle ADW is integrated with Oracle Analytics. Benefits of this combination include

>> **Complete solution for analytics:** A single platform that empowers your entire organization to ask any question of any data type. With Oracle ADW, you can load and analyze data in the cloud in

a few clicks, allowing you to quickly extract data insights and make critical decisions in real time.

>> **Reduced cost and risk:** If you're moving from Amazon's Redshift to Oracle's Autonomous Database, you can expect to cut your costs in half, while benefiting from a higher database availability.

>> **Easy migration:** Oracle makes it easy to migrate your data warehouse or data marts to ADW Cloud. Oracle SQL Developer easily migrates data into the cloud in just a few clicks. Cloud-ready migration workbench tools support all major database providers, including Redshift.

>> **Preservation of your existing investment:** On-premises Oracle data management workloads are 100 percent compatible with Oracle Cloud, ensuring that customers can leverage existing investments and skills. With Amazon Redshift, customers must completely rework their code and realign their applications.

In addition, Oracle ADW includes Oracle Machine Learning, a SQL notebook interface for data scientists to perform ML. Oracle Machine Learning SQL notebooks provide easy access to Oracle's parallelized, scalable, in-database implementations of a library of Oracle Advanced Analytics ML algorithms. This enables teams to collaborate to build, evaluate, and deploy predictive models and analytical methodologies in ADW. These SQL

notebooks and Advanced Analytics ML SQL functions combined with PL/SQL allow companies to automate their discovery of new insights, generate predictions, and add AI to data.

> **TIP**
>
> Learn more about Oracle ADW at `www.oracle.com/autonomous-database/autonomous-data-warehouse`.

Oracle Autonomous Transaction Processing (ATP)

Oracle Autonomous Transaction Processing (ATP) is one of a growing family of cloud services built on the self-driving, self-securing, and self-repairing Oracle Autonomous Database. ATP uses ML and automation to minimize human labor, human error, and manual tuning, delivering unprecedented cost savings, security, availability, productivity, and speed for running transaction applications and mixed workload type applications. ATP supports multiple data types and a complex mix of high-performance transactions, reporting, batch, IoT, and ML in a single database, allowing much simpler application development and deployment and enabling real-time analytics, personalization, and fraud detection.

Benefits of Oracle ATP include the following:

» **Accelerating innovation:** Developers become more agile by instantly provisioning and effortlessly using databases with this self-service database. Integrated ML algorithms enable the development of applications that perform real-time predictions such as personalized shopping and fraud detection. Eliminating manual database maintenance allows database administrators to focus on getting more value from data. The simplicity of upgrading existing databases to the autonomous cloud enables IT to transform to a modern, agile cloud model. The low-code application development tool Oracle Application Express (APEX), which is integrated with ATP, allows anyone to build data-driven applications without writing a single line of code. Its web-based interface is very easy to use and provides several functionalities to build any business application. These capabilities allow developers to focus on building their applications without having to worry about the data. They can build cloud-native applications using any language or any data type tools using Representational State Transfer (REST)

application programming interfaces (APIs) and modern application development frameworks:

- Deploy new applications in minutes versus months.

- Orchestrate your infrastructure and database in seconds.

» **Reducing risks:** By automatically protecting itself from internal and external vulnerabilities and attacks, ATP simplifies security and compliance and reduces the risk of human error, making applications more reliable and resilient. Application continuity ensures applications are always up, despite any failures or errors. These capabilities also save application development efforts by automatically addressing many security, compliance, reliability, and resilience aspects of applications.

» **Lowering costs:** Putting your transaction processing workloads in Oracle Cloud ensures limitless performance. You can automatically, instantly, and transparently scale up or scale out as demand increases, making it easy to accommodate peak processing workloads. Elastic and independent automated scaling of compute and storage resources controls costs and enables true pay per use. You can deploy new apps in minutes versus

months. But the real cost savings come from automated scaling and a reduction in human labor, allowing your team to improve productivity by focusing on innovation rather than administration:

- Complete automation of database and infrastructure operations cuts administrative costs up to 80 percent.

- Cut your Amazon bill in half when you run the same database workload on Oracle ATP Cloud as compared to running on Amazon Web Services (AWS).

- Oracle's Bring Your Own License program allows you to apply your on-premises software licenses to equivalent Oracle services in the cloud.

> **TIP**
> Learn more about Oracle ATP at `www.oracle.com/autonomous-database/autonomous-transaction-processing`.

Oracle Autonomous JSON Database (AJD)

Oracle Autonomous JSON Database is a cloud document database service that makes developing JSON-centric applications simple. It features simple document APIs;

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serverless scaling; high-performance atomicity, consistency, isolation, durability (ACID) transactions; comprehensive security; and low pay-per-use pricing.

Because AJD is an Autonomous Database service, it automates all database management, delivering 99.995 percent availability. Features and capabilities include the following:

>> **Simple document APIs:** Open-source NoSQL-style document APIs enable developers to create JSON-centric applications in minutes without worrying about data models or writing complex code that can takes hours.

>> **Choice of APIs, language, and tools:** Accelerate application development in popular programming languages and platforms such as Java, Python, and Node.js with flexible options including REST API, command-line interface (CLI), integrated development environment (IDE) extensions, and web interface access.

>> **Large native JSON files:** Supports new native binary JSON file sizes of up to 32MB (twice the size of MongoDB Atlas) and is highly optimized for fast reads and partial updates.

>> **Indexing without limitation:** Provides no limitation on index key lengths or number of indexes per collection, and supports full document indexing.

- **›› Full SQL support:** Enables developers to analyze JSON data with all the power of standard SQL, including cross-collection queries, parallel scalability, and advanced analytic functions.

- **›› One-click conversion to multi-model database:** Single-click transformation of an Autonomous JSON Database to an Autonomous Transaction Processing database adds relational data capabilities with no downtime.

- **›› No-code/low-code development:** Built-in Oracle Application Express (APEX), a low-code application development platform, enables developers to rapidly build JSON-centric applications with 98 percent less code.

TIP

Learn more at www.oracle.com/autonomous-database/autonomous-json-database.

Oracle Autonomous Database: Shared, Dedicated, or Cloud@Customer

Oracle Autonomous Database can be deployed on Oracle's public cloud in a shared or dedicated infrastructure. It's also available on-premises on Oracle's Cloud@Customer

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infrastructure. Learn more about Oracle Cloud@ Customer at `www.oracle.com/cloud/cloud-at-customer`.

By using Autonomous Database on shared Exadata infrastructure, you can automate many aspects of infrastructure and database management with Oracle. Users simply select what type of database they want, which region in the Oracle Cloud they want the database deployed, and the base compute and storage resources. Oracle automatically takes care of everything else for them. After it's provisioned, the database can be instantly scaled through the user interface (UI), APIs, or automatically while online, based on the customers' workload needs.

Autonomous Database Dedicated allows customers to implement a Private Database Cloud running on their own dedicated Exadata infrastructure within the Oracle public cloud, making it an ideal platform to consolidate multiple databases regardless of their workload type or size or to offer database as a service (DBaaS) within an enterprise. Dedicated infrastructure provides complete isolation from other tenants and provides an opportunity to customize operational policies, such as software update schedules, availability, and density, to match your business requirements.

The customer's administrator simply specifies the size, region, and availability domain where they want their dedicated Exadata infrastructure provisioned. They also can determine the update or patching schedule if desired, giving the customer full control. Oracle automatically manages all patching activity, but you can specify which month every quarter you want, which week in that month, which day in that week, and which patching window within that day. You can also dynamically change the scheduled patching date and time for a specific database if the originally scheduled time becomes inconvenient.

If you have stringent regulatory, data sovereignty, or network latency requirements that prevent you from putting your data in the public cloud, then you have the option of running the Autonomous Database in your data center on Exadata Cloud@Customer. Oracle manages the database for you and provides all the autonomous bene-fits of the public cloud in your data center. This enables IT to easily deliver self-service databases to business users and developers while ensuring security and gover-nance of all data.

Regardless of which Autonomous Database deployment you choose, you get the same great features, functional-ity, security, and performance you expect from the Oracle Database.

Oracle Data Safe

Oracle Data Safe, which is available free with Oracle Autonomous Database, helps organizations manage risk from threat vectors inherent to operational databases like risky users, sensitive data, and misconfigurations by adding security and compliance solutions to mitigate risks that have traditionally been considered the customer's responsibility. Data Safe provides security risk assessments, user risk assessments, database activity auditing, sensitive data discovery, and data masking — all in a simple, unified security control center.

Along with Oracle Autonomous Database, Data Safe delivers essential data security capabilities as a service on Oracle Cloud Infrastructure. These assessment results help you determine the security steps your organization needs to take. With the Data Safe console you can

» Assess whether your database is securely configured.

» Review and mitigate security risks based on European Union (EU) General Data Protection Regulation (GDPR), Defense Information Systems Agency (DISA) Security Technical Implementation Guides (STIGs), CIS Benchmarks, Oracle best practices, and/or custom specifications.

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- **»** Assess user risk by highlighting critical users, roles, and privileges.

- **»** Configure audit policies and collect user database activity to identify anomalous behavior.

- **»** Discover sensitive data by data type, understand how much there is, and find out where it resides in the system.

- **»** Remove risk from non-production data sets by masking sensitive data.

TIP

Test out Oracle Autonomous Database for free, including powerful tools such as Oracle APEX and Oracle SQL Developer. Learn more at www.oracle.com/cloud/free.

Chapter **4**

Exploring Use Cases and Customer Successes

I n this chapter, you look at Oracle Autonomous Database use cases and a sample of customer successes.

Less Administration, More Innovation

Most IT departments spend nearly 70 percent of their time maintaining existing information systems, leaving little time to focus on innovation. Oracle Autonomous Database intelligently handles routine maintenance tasks like provisioning, patching, and tuning, freeing IT teams to tackle high-value projects for the business, such as obtaining new insights from the data.

OUTFRONT MEDIA: BUILDING A CLOUD ANALYTICS PRACTICE AND DRIVING BUSINESS INSIGHTS WITH AUTONOMOUS TECHNOLOGIES

OUTFRONT Media, Inc., is a leader in out-of-home advertising with more than 400,000 digital and static billboards in cities across the United States and Canada.

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OUTFRONT Media built an analytics practice in the cloud by adopting autonomous database technologies and drives business insights with Oracle Autonomous Data Warehouse and Oracle Analytics Cloud. The benefits realized by the technology services organization are faster time to market, enhanced performance and scalability, a more flexible cost model, and collaboration with business lines to create more valuable reports and dashboards.

Challenges

- Empower line-of-business users and executives with data visualization and analytics dashboards to quickly and easily analyze revenue trends and identify opportunities within advertiser spend profiles.

- Tune, patch, and administer large databases, and merge unstructured data without having to invest in hardware and manage infrastructure.

Solutions

- Oracle Autonomous Data Warehouse

- Oracle Analytics Cloud

(continued)

Results

- Self-driving data warehouse provisioned in minutes versus months

- Self-tuning reduced complex revenue query time from six minutes to two seconds

- Terabytes of third-party media spend ingested in minutes to augment sales opportunities

Reduce Costs, Speed Time to Market

Oracle Autonomous Database is delivered via a pay-per-use model, which can cut runtime costs by as much as 90 percent. By provisioning a new database in seconds, you can accelerate time to innovation, time to market, and time to action. This service scales to fit your capacity requirements, so you can get new projects off the ground quickly, dial them down as necessary, and pay only for what you use.

AGEA CLARÍN: DRIVING DIGITAL TRANSFORMATION AND DELIVERING CUSTOMER ANALYTICS WITH AUTONOMOUS TECHNOLOGIES

Agea publishes the leading Latin American newspaper, *Clarín,* and is headquartered in Argentina. Agea is accelerating its digital transformation by utilizing autonomous database technologies and driving business insights with Oracle Autonomous Data Warehouse and Oracle Big Data Appliance. The benefits are higher productivity, lower costs, and faster time to market, freeing up staff to focus more time on strategic marketing analysis and what readers and advertisers want.

Challenges

- Transform from content-centric to customer-centric by building a 360-degree customer view, tracking 20 billion clicks and searches

per day to segment and predict customer behavior.

- Maintain, tune, and patch a large data warehouse and data lake without technical and administrative resources.

Solutions

- Oracle Autonomous Data Warehouse

- Oracle Big Data Appliance

- Oracle Marketing Cloud (software as a service [SaaS])

Results

- Fifty percent cost reduction versus on-premises appliance

- 2GB per day of subscriber profiles uploaded in 30 minutes instead of three hours

- Five hundred marketing campaigns per month with fewer staff as opposed to one campaign taking five days

TELSTRA CONSOLIDATES DOZENS OF CUSTOM INTERNAL TOOLS ON ORACLE APEX, SAVING MILLIONS PER YEAR IN IT COSTS

Telstra, an international telecommunications and media company, has built Australia's largest and most reliable mobile network.

Challenges

In the early 2000s, the company discovered that internal applications built using Microsoft Access were clogging network bandwidth due to the chattiness of Forms.

Solutions

- Oracle Database

- Oracle Application Express (APEX)

(continued)

Results

Telstra saved big by consolidating these internal apps and replacing them. A community platform called Telstra APEX Central is composed of an Oracle Application Server and a three-node Oracle Real Application Clusters (RAC) database.

The company turned 3,000 Microsoft Access databases, costing AU$15,000 per compute instance to run, into a two-instance Oracle APEX deployment — shaving AU$51 million off Telstra's data center costs.

Not only did Oracle APEX save tens of millions in IT costs, but it enabled employees to easily create and spin up their own internal APEX apps for such things as customer satisfaction and data, pay phone orders, and IT environment provisioning. Oracle RAC allows Telstra to run a single database across multiple servers in order to maximize availability.

Since installing its on-premises data center in the early 2000s, Telstra has enjoyed using Oracle APEX, which comes at no additional cost with the Oracle Database, to develop apps. Today, the company continues to reduce

> maintenance costs by consolidating and moving new applications onto Telstra APEX Central.
>
> The largest of these is for 5G rollout. DBTECH is another large internal tool, running 20 to 30 applications for a mix of IT and business users on a single APEX workspace. But that's not all: On APEX Central platform, Telstra's citizen developers are able to create their own solutions quickly, without having to make a formal IT request for provisioning or custom coding.

Deliver Fast — Automatically

Oracle Autonomous Database provides enterprises with the full benefits of the cloud, including the capability to instantly and automatically scale up or down to meet business demands. Adaptive machine learning (ML) technology automatically tunes, upgrades, and patches the database while it's running, even as workloads increase and decrease. That means your organization will always have the database capacity it needs to stay on the forefront of innovation, and your workloads will run optimally and deliver the performance your business requires.

MESTEC: REVOLUTIONIZING MANUFACTURING PERFORMANCE WITH ORACLE AUTONOMOUS DATABASE

MESTEC provides intelligent SaaS solutions to optimize the life cycle from planning to execution for some of the world's most prestigious manufacturers of submarines, missiles, micro-semiconductors, orthopedic hips, and pastry pies. Moving MESTEC's legacy on-premises infrastructure to the Oracle Autonomous Database that has zero downtime allows the company to more strategically focus resources on innovating tools to improve manufacturing quality, cost, and delivery performance.

Using Oracle Autonomous Transaction Processing in combination with Microsoft Azure Interconnect has helped MESTEC cut its labor and infrastructure costs in half compared to an equivalent on-premises environment. It's seeing

workloads run up to 600 percent faster, with half as many CPUs. Autonomous Transaction Processing patches, maintains, and tunes itself, providing a more secure environment that frees up resources to spend more valuable time on customer services and training. MESTEC also gained greater flexibility to autoscale capacity up and down in seconds depending on demand, and can very easily and quickly onboard new customers while assuming less risk with automatic disaster recovery.

Challenges

- Maintain high availability for a 24/7 industry like manufacturing.

- Move from legacy on-premises infrastructure to a cloud with zero downtime.

Solutions

- Oracle Autonomous Transaction Processing

- Microsoft Azure Interconnect

Results

- Sixty percent increase in labor productivity

- Fifty percent reduction in customer complaints

- Twenty percent reduction in working inventory

Accelerate Innovation

With little or no manual intervention, the Oracle Autonomous Database automates patching, upgrades, and tuning, allowing customers to instantly create new databases and easily convert existing databases while dramatically reducing costs. Customers can accelerate time to market with new products, offerings, and innovations in the range of 40 percent to 70 percent.

SIEMENS MOBILITY: SIMPLIFY PROJECT MANAGEMENT AND HELP LAUNCH NEW PRODUCTS FASTER WITH ORACLE AUTONOMOUS DATABASE

Siemens Mobility is a global leader for seamless transportation solutions, including creating an intelligent infrastructure for rail automation and road traffic services. As part of its goal to enhance the commuter experience and help shape the future of transportation, Siemens Mobility is working with European rail operators to modernize thousands of kilometers of rail traffic with a new train signal control system to improve efficiency and utilization. Siemens Mobility used Oracle Autonomous Transaction Processing (OATP) as its project management platform. OATP offers faster time to market, greater performance, less administration, and lower costs than other on-premises or cloud platforms.

(continued)

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Challenges

- This transformation project involved many stakeholders and documents to direct operations.

- Multiple countries in the initial phase required a way to project-manage and simplify the complexity.

Solutions

- Oracle Autonomous Database

- Oracle Autonomous Transaction Processing

Results

- Information automatically consolidated with one click, replacing a manual input process

- New cloud-based autonomous database launched within two weeks instead of months

- Up to 90 percent cost and time savings compared to on-premises options

- More efficient document management process requiring minimal admin and training

RETRACED USES ORACLE AUTONOMOUS DATABASE WITH BLOCKCHAIN TO INCREASE SUSTAINABILITY IN THE APPAREL INDUSTRY

Despite some fashion brands' efforts to mandate safe and upstanding working conditions at the factories they buy from, there hasn't been much visibility into the increasing volume of subcontracted work. The mission of retraced is to enable its manufacturing customers to provide that supply-chain visibility, via a blockchain application that lets consumers know exactly who made its products, from which materials, and under what conditions. The key to that brand promise is the ability to reassure customers that they can trust that the data in the app is reliable and verified.

Challenges

It made sense for retraced, a participant in the Oracle for Startups program, to turn to Oracle for the underlying infrastructure for blockchain and other database technologies it needed to

build that trust. Oracle Autonomous Database and Oracle Blockchain Platform ensure that the data collected at every step of each customer's supply chain is reliable. Also, the data can't be altered or erased without the knowledge of all participants in the chain. "Whenever we had questions, we could go to the guys at Oracle, and the next day we had a call for an hour with an expert," says retraced Cofounder Lukas Pünder.

Solutions

- Oracle Analytics
- Oracle Autonomous Database
- Oracle Cloud Compute

Results

With the help of Oracle's technology and expertise, retraced managed to go from project start to launch within 12 months. The company's early customers include CANO, a Mexico-based designer of ethically handcrafted leather-woven huaraches, and Jyoti – Fair Works, a German "fair fashion" label that uses retraced's app to help it

map, verify, and store its suppliers' activities. retraced stores and analyzes data in Oracle Autonomous JavaScript Object Notation (JSON) Database, Oracle Autonomous Data Warehouse, and Oracle Analytics, all of which run on Oracle Cloud Infrastructure. It stores a variety of JSON documents connected with the application, including copies of orders placed by brands with suppliers and images associated with products, components, brands, factories, farms, and so on. "Having the infrastructure, database, and blockchain application running on one platform made it so much easier for us to expand our platform very quickly and at scale," says retraced co-founder and CTO Peter Merkert.

The application's microservices architecture quickly pulls in fabric images, onboards new suppliers, or adds orders to the blockchain. Its Oracle Container Engine for Kubernetes "lets us run multiple instances simultaneously, even when the application is getting hit with thousands of requests at once," Merkert says. And with its Oracle Autonomous Transaction Processing Database, "it really doesn't matter how many processes I'm running," he says. "I can just click to get more storage, click again to get more CPU power, and boom, it's there. With

> Oracle Cloud, networking and backup are highly
> automated, so our small, lean development
> team is more focused on business solutions that
> add value to our customers."

REMEMBER From publishers to software providers,
Oracle Autonomous Database has helped
evolve the way industries become more
customer-centric, reduce IT infrastructure
costs, and save time bringing products to
market. Discover more successes at `www.`
`oracle.com/autonomous-database/`
`customers`.

Chapter **5**

Ten Reasons for Choosing Oracle Autonomous Database

I n this chapter, I outline ten reasons you should choose Oracle Autonomous Database for your organization.

Oracle Leadership in Automation and Emerging Technologies

Oracle has been simplifying the management, tuning, and administration of Oracle Database for decades, and many of the sophisticated technologies designed to streamline activities for database administrators (DBAs) are now fully automated.

The Autonomous Database is a fairly recent offering from Oracle; however, the journey toward automation and self-driving capabilities began more than 20 years ago, with the introduction of Oracle Database 9i.

Many sophisticated automation capabilities were introduced and have since evolved, including space and memory management, workload monitoring, and database tuning, all of which are used in the Autonomous Database. In addition to automated database management, Oracle has spent the last decade developing the ideal automated database infrastructure, namely the Oracle Exadata Infrastructure, the only preconfigured, pretested, and preoptimized platform specifically for Oracle Database.

Automation drives innovation — manual database management chores become a thing of the past with Oracle

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Autonomous Database. Database administrators will invariably spend more time on high-value activities such as database design, schema design, analytics, and setting policies for database use, thus becoming *data modernization engineers* and *data architects,* responsible for data modeling, data security, and performance monitoring — essential capabilities that will help them gain greater insights within the business as their roles grow in importance.

Optimized Cloud Infrastructure

Oracle Cloud Infrastructure (OCI) serves as the foundational infrastructure layer for Oracle Autonomous Database and across all applications and platform services. It's specifically architected to provide the performance predictability, security, governance, and transparency required for enterprise workloads.

OCI is an infrastructure as a service (IaaS) offering that delivers on-premises, high-performance computing power to run cloud-native and enterprise IT workloads. OCI provides real-time elasticity for enterprise applications by combining Oracle's autonomous services, integrated security, and serverless compute.

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Workloads such as data warehousing and transaction processing will run best on an infrastructure designed to provide low latency, high availability, resiliency, and consistent performance. These are the core tenets of OCI.

Easy On-Ramp to Cloud

For IT leaders who want to move enterprise IT to a cloud foundation, the Autonomous Database offers the smoothest and easiest transition. The Autonomous Database offers familiar tooling and maximum compatibility with Oracle Database to help customers easily move their existing apps to this new cloud data management platform without recoding.

Oracle Cloud offers automated cloud migration tooling and at the same time ensures compatibility of on-premises workloads for cloud deployment. This rapid upgrade enables Oracle customers to save time, cut costs, preserve existing investment, and stay focused on business.

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

In-Depth Security

Oracle Autonomous Database simplifies database administration and security update tasks, including automatically maintaining security configurations. Oracle Autonomous Database can adapt to changing conditions, driven by machine learning (ML) technology that automatically applies security updates, and detects and fixes problems without human interaction — a capability known as *adaptive response.*

> With ML, the system gets smarter over time: The more data it studies, the more users it gets to know, the more applications that come under its purview, and the better it can understand rogue or suspicious behavior when it occurs.

Oracle facilitates rapid detection, investigation, and remediation of a broad range of security threats based on algorithms that can identify patterns in the data. The system can even make predictions about the likelihood of future breaches based on historical activity. Bolstered by ML algorithms, it learns what constitutes typical behavior for each application. It defines a baseline for user behavior, against which deviations can be measured.

This adaptable system continually learns new things such as where employees work, what devices they use, and how their personal computing environments change

day to day. An artificial intelligence (AI) algorithm processes the data to identify patterns, create audit reports, and detect security risk indicators based on predefined threat models, baseline risk indicators, abnormal events, and suspicious user activity. These automated capabilities bring greater visibility and intelligence to cybersecurity activities.

Multiple Deployment Options

Oracle's Autonomous Database is the only cloud database that is available in the public cloud, as well as on premises. It can be deployed in the public cloud on shared or dedicated infrastructure. Because shared deployment is the cheapest option to get started and has no minimum commitment, it is the preferred option for businesses building new applications or moving individual applications to the cloud. It gives them all the automated database management in the cloud and self-service capabilities for their developers and analysts to get started with their projects.

For mission-critical applications that can run in the public cloud but need complete isolation of data and operations and greater control over operational policies — such as patching windows, upgrades, and so on — using the Autonomous Database in a dedicated environment in the public cloud is a preferred option.

Lastly, for businesses that can't move their data to the public cloud but want all the benefits of a fully autonomous cloud database, using the Autonomous Database on Cloud@Customer is the optimal option where Oracle brings the Autonomous Database inside a customer's data center.

Because it's the same database running in all the three different deployment options, it becomes easy to do dev/test in the public cloud and then deploy on premises or to the public cloud for disaster recovery, and have your production on premises or move your application from on premises to public cloud — without any rewrites or code changes.

Real-Time Analytics

Data is growing at an exponential rate, presenting companies with new types of information management challenges.

TECHNICAL STUFF

Oracle Autonomous Database is pre-integrated with ML to perform automatic caching, adaptive caching, and adaptive indexing. This gives customers all the benefits of running a data warehouse on Oracle Exadata, including columnar compression.

With Oracle Autonomous Database, creating a data warehouse is a simple "load-and-go" process. Migrating existing on-premises data warehouses to the cloud — or creating a new data warehouse altogether — is easy. Users simply specify tables, load data, and then run their workloads in a matter of seconds. All data is automatically compressed and encrypted. You can take advantage of a wide range of platform services for business intelligence, as well as use Oracle's cloud-based integration services to accommodate third-party analytics. You can run analytics on any data type, structured or semistructured, to deliver valuable insights for your business.

Faster Application Development

Oracle is committed to helping customers develop applications faster by providing the best performance, scalability, reliability, and security for their data. The Autonomous Database allows developers to run standard Structured Query Language (SQL) queries on any data including:

» Relational

» JavaScript Object Notation (JSON)

» Extensible Markup Language (XML)

- >> Graph

- >> Spatial

- >> Online analytical processing (OLAP)

- >> Blockchain

It includes a wide variety of tools and features to improve productivity, including in-database JavaScript, automated machine learning (AutoML), SQL macros, microservices, events, continuous integration (CI)/continuous deployment (CD), Representational State Transfer (REST) data services, SQL Developer Web, and a low-code application development platform called Oracle Application Express (APEX). These capabilities and features help developers build any kind of application to solve any type of business problem while Oracle manages their data.

Innovate Rather Than Administrate

As manual database management chores become a thing of the past with Oracle Autonomous Database, DBAs will invariably spend more time on high-value activities such as database design, schema design, analytics, and setting policies for database use.

DBAs will become *data modernization engineers* and *data architects.* They must understand the importance of the

data to key business stakeholders and assume more important roles in driving their businesses forward. They will be responsible for data modeling, data security, and performance monitoring — essential capabilities that will help them gain greater insights within the business as their roles grow in importance.

Easy to Get Started with Oracle

You can try Oracle Autonomous Database with Oracle Cloud Free Tier, which allows you to build, test, and deploy applications on Oracle Cloud for free.

Always Free services are available for an unlimited time and include the following:

- ❯❯ Three Oracle Autonomous Databases (each include powerful tools such as Oracle APEX and Oracle SQL Developer Web): Autonomous Transaction Processing, Autonomous Data Warehouse, and Autonomous JSON Database

- ❯❯ Two OCI Compute virtual machines (VMs)

- ❯❯ Block, object, and archive storage

- ❯❯ Load balancer, monitoring, and notifications

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In addition, you get a 30-day free trial with $300 of free credits, which you can use to try other Oracle Cloud services, more instances, or larger shapes.

Services available in the free trial include Autonomous Database, other database cloud services, Analytics, Digital Assistant, Compute, Container Engine for Kubernetes, and other Cloud Native Services. Go to `www.oracle.com/cloud/free` to get started.

Beyond the free offerings, Oracle offers two programs to make it easier for you to buy and consume cloud services, helping you get more value from your hardware and software investments:

>> **Oracle Universal Credit Pricing** allows you to access current and future OCI services under a single umbrella contract.

>> Oracle's **Bring Your Own License** program allows you to apply your on-premises software licenses to equivalent Oracle services in the cloud.

These programs alleviate cloud adoption challenges by simplifying the way your organization purchases and consumes cloud services.

Low Cost, Simple Pricing and Proven

Intelligent data management delivers more scalability, simplicity, and security to enable companies to make faster decisions and derive more value from their data. Calculate the value of automation in three quick steps and see how much you can save with the Oracle Autonomous Database. Get your personalized report at `www.oracle.com/goto/tco-databasecloud`.

Finally, Oracle has a proven track record of innovation and customer success. Some of those customer successes are highlighted in Chapter 4. View more at `www.oracle.com/autonomous-database/customers`.

ORACLE CUSTOMERS SHARE THEIR AUTONOMOUS DATABASE EXPERIENCES

"Oracle Autonomous Data Warehouse has reduced time to market for a typical data warehouse project from 3 months to 3 days, while delivering deeper and more actionable insights."

—*Steven Chang, CIO, Kingold*

"The room for growth is enormous—35,000 financial institutions can use our software. How to get to them? By distributing our technology in the cloud, as software as a service."

—*Erik Brieva, CEO, Strands*

"The biggest advantage of Oracle Autonomous Data Warehouse is it significantly cut down processing time and helped simplify reporting and analytics, so we could go to market much faster."

—*Ronald Prasad, COO, Vodafone Fiji*

"The new Autonomous Database capabilities for drag-and-drop data loading and transformation, as well as automatic insight discovery, go one step further in terms of automatisation."

—*Manuel Martin Marquez, Big Data project Leader, CERN*

"With Autonomous Data Warehouse, we are able to gain real-time insights into customer behavior using around 2 million transactions per day, independently from IT."

—*Pawarit Ruengsuksilp, Project Consultant, Forth Corporation*

"When customer experience is on the line, every second counts. You need speed, efficiency, and accuracy to deliver on your customers' expectations. With Oracle Autonomous Database, we can now take on a customer of any size."

—*Craig Wilensky, CEO, JASCI Software*

"Reopening the Pompeii site to tourists after lockdown was tough. With Oracle's help, we delivered the cloud native mobile solution in just six weeks."

—*Alberto Bruni, COO, Archaeological Park of Pompeii*

"One of the things I value the most is rapidness, the flexibility to increase or reduce resources. Now we can give the business a platform that we know will respond, and it will be done in a matter of minutes."

—*Hector Silva, Director of IT Architecture, Unicomer*

"From an administrative perspective, we can on-board data from different sources more efficiently and with less issues using Oracle Autonomous Data Warehouse's declarative ELT."

—*Steve Chamberlin, CEO, Sensa Analytics*

"We are excited about the new data transformation features in Autonomous Database. We like how you can ingest, transform and analyze data in a straightforward and simplified way."

—*Tom Miller, CTO, Drop Tank*

Discover the power of an autonomous database

Oracle Autonomous Database marks the culmination of four decades of technology innovation with the integration of new emerging technologies. Powered by machine learning and artificial intelligence, and built on Oracle Cloud Infrastructure, Autonomous Database is a self-driving, self-securing, and self-repairing database that reshapes Oracle customers' IT approach, allowing them to free their budgets, reallocate their resources, and reduce risk while focusing on business growth and the next wave of innovation.

Inside…

- Extract more value from your data
- Accelerate digital transformation
- Automatically manage your data
- Leverage AI and ML to gain insights
- Democratize data-driven decision making with self-service capabilities
- Bring DBAs closer to the business
- Enable real-time analytics

ORACLE

Lawrence Miller, CISSP has worked in information technology in various industries for more than 25 years. He is the co-author of *CISSP For Dummies* and has written more than 150 other *For Dummies* books on numerous technology and security topics.

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