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Oracle Autonomous Database

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Discover the business value of autonomous

Deploy a data warehouse in seconds

Explore autonomous use cases

Lawrence Miller, CISSP

2nd Special Edition

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Introduction

Emerging technologies and automation permeate every aspect of our work and lives today. The real opportunity of these technologies — which include artificial intelligence (AI), machine learning, the Internet of Things (IoT), and human interfaces — is to enable us to embrace innovation on a scale never seen before. These technologies help us reimagine what's possible in work and in life — from 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 Oracle's Cloud platform and infrastructure (Chapter 2)
- Introduce Oracle's Autonomous Data Warehouse Cloud and Autonomous Transaction Processing (Chapter 3)
- Examine Autonomous Database use cases and real-world success stories (Chapter 4)
- Outline why you should choose Oracle Autonomous Database for your enterprise (Chapter 5)

Foolish Assumptions

It's been said that most assumptions have outlived 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 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!

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

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

WARNING

This icon points out the stuff your mother warned you about. Okay, probably not. But you should take heed nonetheless!

Beyond the Book

Although this book is chock-full of information, there's only so much I can cover in 64 pages! So, if you find yourself at the end of this book thinking, "Gosh, this was an amazing book — where can I learn more?" just go to `www.oracle.com/database/autonomous-database`.

Where to Go from Here

If you don't know where you're going, any chapter will get you there — but Chapter 1 might be a good place to start! However, if you see a particular topic that piques your interest, feel free to jump ahead to that chapter. Each chapter is written to stand on its own, so feel free to start reading anywhere and skip around to your heart's content! Read this book in any order that suits you (but I don't recommend upside down or backward).

IN THIS CHAPTER

- Enabling greater innovation with autonomous technologies
- Balancing opportunities and challenges to achieve digital transformation

Chapter 1
Why Autonomous?

In this chapter, you learn how autonomous technologies benefit businesses today, and how emerging technology trends are driving new opportunities and challenges.

Recognizing the Business Value of Autonomous

Relational databases have made tremendous improvements in performance, availability, and security over the past couple of decades. They can run up to 100 times

faster; can be configured for zero data loss; and have hardened security capabilities that can protect against malicious internal and external threats. These attributes have been enhanced by cloud databases and infrastructure services that deliver elastic scalability and provisioning for real-time agility and growth. 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, and management can also be automated, leading to greater operational efficiencies and cost savings.

So, what's missing? The degree of manual intervention required to manage today's cloud databases and all these attributes inhibits true Database as a Service (DBaaS) — as a utility, or "driverless" offering, if you will. As a result, enterprises are unable to realize the full operational and financial benefits of the cloud.

WARNING

Automatic and *autonomous* are not the same thing. 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. The

design goal is to minimize or eliminate human labor — and associated human error — and ensure data safety and optimal performance.

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. An autonomous database can help organizations transform IT operations into a modern cloud model that simplifies processes, reduces inefficiencies, 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

Machine learning and artificial intelligence (AI) are fundamentally altering enterprise computing by transforming how organizations receive, manage, and secure business data.

TIP

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

Autonomous technologies, enabled by machine learning 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.

However, as with all opportunities, challenges exist. Perhaps one of the most important challenges today is security. As we become more connected, cyberthreats 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. Security teams at organizations of every size are struggling to keep pace with these persistent attacks.

Here are a few examples of the challenges that enterprises are facing today:

- **Patching:** Whether it's because they don't have the resources or because they have difficulty scheduling the necessary downtime, most companies simply can't install security patches fast enough. According

to a Verizon study, 85 percent of successful breaches exploited vulnerabilities for which patches were available up to a year before the attack occurred.

- **Talent:** There simply isn't enough cybersecurity talent to handle the problem. Current estimates suggest there will be 3.5 million open cybersecurity jobs by 2021. Ultimately, autonomous technologies are needed to successfully address the growing threat landscape.
- **Alert overload:** On average, approximately 17,000 alerts are generated every week in an enterprise IT environment and only 19 percent of these alerts are reliable. Worse yet, only 4 percent of alerts are actually investigated. It's critical for companies to be able to separate the signal from all the noise — to understand and respond to the real threats.

So, how can we reconcile these competing forces of addressing these threats while at the same time transforming the enterprise to enable innovation and take advantage of these opportunities? To do that, companies need a platform that's autonomous — that leverages the power of AI and machine learning. With autonomous technologies, we can fight back against cybercriminals, reducing risk by using machines to fight machines. And at the same time, we can use them to drive real innovation and real change for our businesses. Using the power of autonomous, enterprises now have the means to unlock their potential like never before.

IN THIS CHAPTER

- Building a high-performance foundation
- Automating security and management
- Boosting developer productivity
- Connecting data and processes
- Gaining better insights
- Introducing Oracle Autonomous Database

Chapter 2

Looking at Oracle Cloud Infrastructure

In this chapter, you learn about Oracle Cloud Infrastructure (OCI). OCI is Oracle's IaaS offering that is the foundational architecture for Oracle cloud offerings.

Oracle Cloud Infrastructure

Workloads such as data warehousing, analytics, and transaction processing run best on an infrastructure designed to provide low latency, high availability, 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. It includes 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. 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) and Autonomous Transaction Processing (ATP) services, discussed later in this chapter and 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.

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

To run these workloads optimally, OCI provides 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. Customers 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.
- **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 Infrastructure as a Service (IaaS) SLA:** 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

Emerging technologies — like cloud, artificial intelligence (AI), and the Internet of Things (IoT) — enable organizations to innovate, drive productivity, and reduce costs, but they also increase the potential for risk due to data sprawl, expanded attack surfaces, performance degradation, and outages, among others. Cybercriminals use these same technologies to attack organizations with increasing sophistication and on a massive scale.

Security teams are often overwhelmed and struggle to keep pace. They rely on manual processes that can introduce human error and take an inordinate amount of time to accurately detect and respond to threats. And there simply isn't enough cybersecurity talent to adequately address the problem. According to Ponemon's *Costs and Consequences of Gaps in Vulnerability Response* (2018), the global cybersecurity workforce shortage is estimated to be 3 million worldwide, with nearly 60 percent of Ponemon's survey respondents indicating that their organizations face a "moderate or extreme risk" of cybersecurity attacks due to this shortage. Even if these open positions could be filled, organizations can't throw enough people at this problem. Humans, no matter how many or how skilled, simply can't handle the seemingly endless onslaught of cyberattacks on their own.

Oracle has been building security into its solutions and protecting its customers' sensitive data for decades.

It has had a long-time focus on security, and this focus is highly important as its customers move to the cloud. Oracle has pursued a secure-by-design cloud for OCI, automating and integrating security into its Software as a Service (SaaS) and Platform as a Service (PaaS) solutions. Oracle Database users have a rich set of security and compliance controls to choose from to protect both on-premises and cloud database deployments. New capabilities that enable customers to secure their portion of the shared responsibility model, such as Oracle Data Safe, are discussed in more detail in Chapter 3.

App Development with Autonomous Database

Oracle Cloud provides an open, modern, easy, and intelligent platform and infrastructure to develop, deploy, and manage applications. Developers using Oracle Cloud can use familiar technologies such as Java and Oracle Database, and innovative technologies such as Autonomous Database, machine learning, cloud-native, serverless, and GraalVM, among others. Oracle Cloud offers developers flexibility and choice, portability, compatibility, and interoperability with other technologies, including open-source and third-party components. 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 data type, 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)


TIP

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

Oracle Integration provides intelligent automation and integration to enable you to deliver your digital modernization projects faster and easier. Through a combination of innovative machine learning, 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.

From purchasing to human resources to supply chain planning, applications teams can leverage the intuitive Oracle Integration platform to easily integrate applications such as Oracle ERP Cloud, Oracle Engagement Cloud, Oracle Marketing Cloud, Oracle E-Business Suite, Siebel, PeopleSoft, JD Edwards, and many non-Oracle applications, including Salesforce, ServiceNow, and SAP. The embedded machine learning recommendation capability learns from other users to make recommendations for mapping.

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. Deployment times that would have taken months are now reduced to a fraction of that time.

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 has been limited because it was human-driven and labor-intensive, requiring specific skills. Oracle Analytics fundamentally changes that.

Oracle Analytics combines machine learning and AI with data to enhance human interactions, eliminate mundane tasks, reduce bias in analysis, and enrich your decision-making and predictive ability. Analytics 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:** It's critical to remove constraints on time and scale. 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 combines embedded machine learning and AI to automate the analysis process. This 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.

Autonomous Database

Oracle has redefined data management with the world's first autonomous database. An autonomous database is a cloud database that uses machine learning to eliminate the human labor associated with database tuning, security, backups, updates, and other routine management tasks traditionally performed by database administrators (DBAs).

Oracle Autonomous Database was born on three foundational elements:

- Oracle's automated database operations
- Oracle's rich, policy-driven optimization, implemented via machine learning
- Optimization to run on Oracle's next-generation infrastructure, delivering on performance and elastic scale.

With Autonomous Database, Oracle fully manages the life cycle; this automation allows its customers to innovate more, pay less, and ensure that their data is more secure. And what makes it so innovative are these core attributes:

- **Self-driving** to automatically provision, secure, monitor, back up, recover, tune, troubleshoot, and

upgrade databases, as well as instantly grow and shrink compute or storage without downtime.

- **Self-securing** to automatically protect itself from internal and external vulnerabilities and attacks by automatically applying all security updates with zero downtime, providing "always on," end-to-end encryption by default, and leveraging Oracle Data Safe to mitigate risk from sensitive data, risky users, and misconfigurations.
- **Self-repairing** to maximize uptime and productivity with 99.995 percent availability (less than 2.5 minutes of planned and unplanned downtime per month).

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

- **Oracle Autonomous Data Warehouse (ADW):** ADW uses adaptive machine learning to deliver unprecedented simplicity, performance, and highly elastic data management that enables data warehouse deployment in seconds.
- **Oracle Autonomous Transaction Processing (ATP):** ATP uses machine learning and automation to eliminate human labor, human error, and manual tuning, delivering unprecedented cost saving,

security, availability, and productivity. ATP supports a complex mix of high-performance transactions, reporting, batch, Internet of Things (IoT), and machine learning in a single database, allowing much simpler application development and deployment and enabling real-time analytics, personalization, and fraud detection.

You learn more about Oracle Autonomous Database, including ADW and ATP, in Chapter 3.

IN THIS CHAPTER

- Looking at Oracle Autonomous Database
- Exploring Oracle Autonomous Data Warehouse
- Discovering Oracle Autonomous Transaction Processing

Chapter 3

Introducing Oracle Autonomous Database

In this chapter, you learn about Oracle Autonomous Database, which is currently offered in two cloud services to meet your organization's data management needs: Autonomous Data Warehouse (ADW) and Autonomous Transaction Processing (ATP).

Oracle Autonomous Database

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 represents an entirely new category of software based on machine learning that dramatically transforms how companies innovate by simplifying processes, boosting efficiencies, and freeing IT resources to focus on innovation. Oracle Cloud puts these emerging technologies to work by allowing customers to establish new IT capabilities quickly, affordably, and securely, and it leverages the power of machine learning.

Oracle's complete, 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).

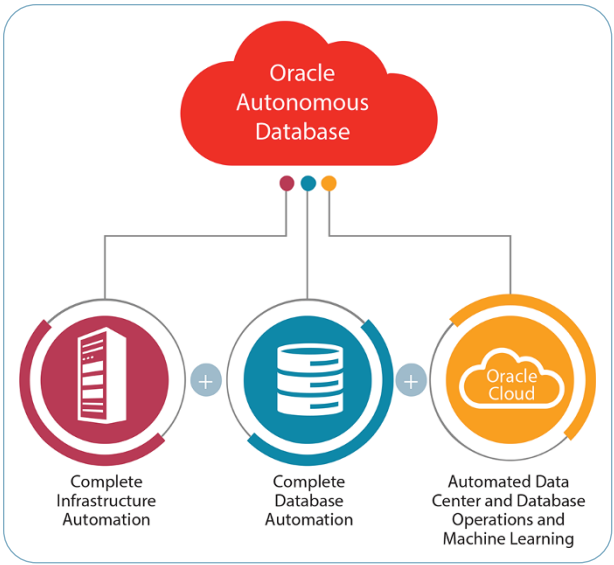

FIGURE 3-1: Oracle Autonomous Database — intelligence at every layer.

Oracle Autonomous Database is designed on three principles (described in the following sections): self-driving, self-securing, and self-repairing.

Self-driving

You 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 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.

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 storage indexes. This provides extreme performance and rapid time to value.

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

Autonomous Database automatically tunes itself using machine learning algorithms, including automatically

creating any indexes needed to accelerate applications. Users get the ultimate simplicity of a "load-and-go" architecture in which they can simply load their data and run SQL without worrying about creating and tuning their database access structures.

Self-securing

The Autonomous Database is more secure than a manually operated database because it 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 customers 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 or 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. Oracle infrastructure and Autonomous Database are both designed to

deliver 99.995 percent availability, 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 self-tuning and preconfigured for automated patching and upgrades and limits manual error-prone human management processing.

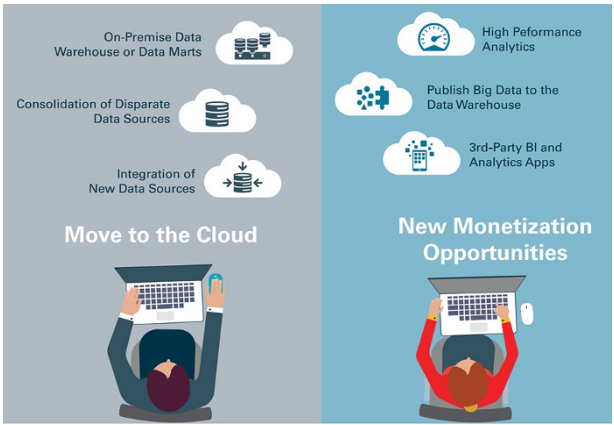

FIGURE 3-2: Common use cases enabled by Oracle ADW.

Oracle ADW is integrated with Oracle Analytics. Customer 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:** Customers moving from Amazon's Redshift to Oracle's Autonomous Database can expect to cut their 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 customers can leverage existing investments and skills. With AWS 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 machine learning. Oracle Machine Learning SQL notebooks provide easy access to Oracle's parallelized, scalable in-database implementations of a library of Oracle Advanced Analytics' machine learning algorithms. This enables teams to collaborate to build, evaluate, and deploy predictive models and analytical methodologies in ADW. These SQL notebooks and Advanced Analytics machine learning SQL functions combined with PL/SQL allow companies to automate their discovery of new insights, generate predictions, and add AI to data.

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 machine learning and automation to minimize human labor, human error, and manual tuning, delivering unprecedented cost savings, security, availability, and production. ATP supports a complex mix of high-performance transactions, reporting, batch, Internet of Things (IoT), and machine learning in a single database, allowing much simpler application development and deployment and enabling real-time analytics, personalization, and fraud detection.

Customer benefits of Oracle ATP include

- **Accelerating innovation:** Developers become more agile by instantly creating and effortlessly using databases that require no manual tuning. Integrated machine learning 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.

- 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, reduces the risk of human error, and frees up high-value resources. 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 mitigate risk from risky users, sensitive data, and misconfigurations. This preventive approach is critical because 85 percent of security breaches today occur after a common vulnerability and exposure (CVE) alert has been issued.
- **Lowering costs:** Putting your transaction processing workloads in Oracle Cloud ensures limitless performance. You can instantly and transparently scale up or scale out as demand increases, making it easy to accommodate peak processing workloads. Elastic and independent 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 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 AWS.
- Oracle's Bring Your Own License program allows you to apply your on-premises software licenses to equivalent Oracle services in the cloud.

Oracle Autonomous Database: Serverless or Dedicated

Oracle Autonomous Database offers two deployment choices: Serverless or Dedicated.

With Autonomous Database Serverless, Oracle automates all aspects of the infrastructure and database management for customers including provisioning, configuring,

monitoring, backing up, and tuning. Users simply select what type of database they want (Data Warehouse or Transaction Processing), 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. Once provisioned, the database can be instantly scaled through the user interface (UI), application programming interfaces (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 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.

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

Oracle Data Safe

Oracle Data Safe 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 customers' 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.
- 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 learn where it resides in the system.
- Remove risk from non-production data sets by masking sensitive data.

IN THIS CHAPTER

- Focusing on innovation
- Reducing cost and time-to-market
- Scaling automatically and on-demand

Chapter 4

Exploring Use Cases and Customer Success Stories

In this chapter, you look at Oracle Autonomous Database use cases and Oracle customer success stories.

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. 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

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 only pay for what you use.

AGEA CLARÍN: DELIVERING TRANSFORMATION AND DRIVING BUSINESS INSIGHTS 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

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 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, microsemiconductors, 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, and 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 has greater flexibility to autoscale capacity up and down in seconds depending on demand, and can very easily and quickly onboard new customers and assume less risk with automatic disaster recovery.

Challenges

- Maintaining high availability for a 24/7 industry like manufacturing
- Moving from legacy on-premises infrastructure to a cloud with zero downtime

(continued)

(continued)

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

Chapter 5

Ten Reasons for Choosing Oracle Autonomous Database

In 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 recent offering from Oracle; however, the journey toward automation and self-driving capabilities began over 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.

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 is specifically architected to provide the performance predictability, security, governance, and transparency required for enterprise workloads.

OCI supports traditional, mission-critical, performance-intensive, and high-performance computing (HPC) workloads usually found in on-premises environments, along with cloud-native and mobile apps.


TIP

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.


REMEMBER

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 technology that automatically applies security updates, and detects and fixes problems without human interaction — a capability known as adaptive response.


TIP

With machine learning, 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 machine learning 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.

Real-Time Analytics

Data is growing at an exponential rate, presenting companies with new types of information management challenges. Analytics are essential to move the business forward, yet 60 percent of respondents to a recent Oracle survey said that their data warehouses were too complex to manage, 33 percent said new database solutions were too slow to deploy, and 19 percent said they were unable to integrate varying data types.

Oracle Autonomous Database is pre-integrated with machine learning 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. It's easy to migrate existing on-premises data warehouses to the cloud — or create a new data warehouse altogether. 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.

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 Try, Buy, and Consume

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:

- Two Oracle Autonomous Databases, either Autonomous Transaction Processing or Autonomous Data Warehouse, with powerful tools such as Oracle Application Express (APEX) and Oracle SQL Developer Web
- Two Oracle Cloud Infrastructure Compute virtual machines (VMs)
- Block, object, and archive storage
- Load balancer, monitoring, and notifications

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` and 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 Oracle Cloud Infrastructure 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 popular programs alleviate cloud adoption challenges by simplifying the way your organization purchases and consumes cloud services.

Familiar Tools and Easy Upgrade

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.

Low Cost, Simple Pricing

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`.

Proven

Oracle has a proven track record of innovation and customer success. In Chapter 4, you can read about Oracle customer success stories with Oracle Autonomous Database, or go to `www.oracle.com/database` to learn more.

Discover the power of autonomous data management

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...

- Leverage machine learning and AI
- Automatically tune databases
- Apply patches with no downtime
- Bring DBAs closer to the business
- Accelerate IT projects
- Enable real-time analytics
- Extract more value from your data

ORACLE®

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