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Security

Secure Critical Data with Oracle Data Safe

Improve the Security of Cloud Databases with a Unified Control Center for Managing Sensitive Data

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THE GROWING NEED TO PROTECT SENSITIVE DATA IN THE CLOUD

Many organizations now consider data to be one of their most valuable organizational assets. However, if that data is not well protected, it can quickly become a liability. Practically every day we hear stories about high-profile data breaches, as well as attacks on individual systems and databases (see sidebar). Growing privacy concerns have increased the regulations that dictate how organizations treat user data, including the European Union's General Data Protection Regulation (GDPR), the United States' Health Insurance Portability and Accountability Act (HIPAA), the new California Consumer Protection Act (CCPA), and other governing bodies. It's an expensive problem, and the associated fines for non-compliance have made it even more so. For example, Marriott was forced to pay more than £99 million in fines; and British Airways faces £183 million in fines for recent GDPR breaches.

Attackers may be full-time employees of a nation-state, members of an organized crime syndicate, or just curiosity seekers, but they all have one thing in common: a propensity to leverage gaps in your security strategy. While some of these attacks are designed to wreak havoc on business operations, others are motivated by a more explicit goal: to steal your data. And since this data typically resides in a database, the latter becomes the prime target for hackers.

In addition to this constant barrage of external threats, companies also face threats from internal users — sometimes intentional, and other times through inadvertent errors, omissions, and oversights involving security software configurations and the associated data.

The distributed nature of today's work teams only exacerbates the problem. Organizations must commonly manage many types of users in many different geographies — including internal DevTest teams and external partner organizations — all of which require differing levels of access to corporate databases.

Data Breaches in the News

- In 2019, Capital One reported one of the top 10 largest data breaches ever. The breach was discovered after details of the hack were posted on the code sharing website, GitHub.
- In April 2019, vpnMentor discovered an unsecured database hosted on Microsoft Azure that contained personal information on nearly 80 million U.S. households.
- In February 2018, FedEx realized that they had inadvertently exposed the personal information from 119,000 of their customers in a database on an unsecured Amazon Web Services (AWS) cloud storage server. The discovery was made by Kromtech Security and it is estimated this information went unsecured for four years before being discovered.

The Cost of Compliance

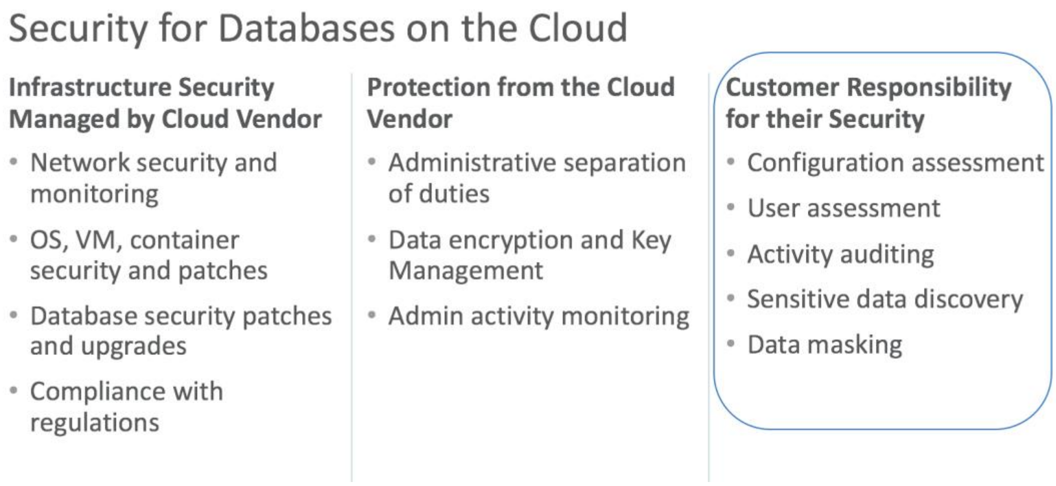
- GDPR fines can be as high as four percent of annual revenue
- HIPAA fines can be US$1.5 million per violation
- CCPA fines will be as high as $700 per individual — plus litigation costs

To mitigate both intentional and unintentional breaches, enterprises need to identify sensitive data, protect it with appropriate controls, and routinely audit usage of that data in database management systems. Some business leaders are concerned about moving databases to the cloud because of these security issues — compounded by a shortage of in-house expertise protecting sensitive data.

This paper describes Oracle Data Safe, an integrated and comprehensive cloud service that ensures data security for cloud databases. Data Safe helps secure your databases via *security* and *user risk assessments*, *user activity auditing*, *sensitive data discovery*, and *data masking*. With this well-integrated and easy-to-use solution, cloud database customers of all sizes and in all verticals can meet their database security requirements very easily.

DEMOCRATIZING SECURITY WITH ORACLE DATA SAFE

As data and applications move to the cloud, the responsibility for securing an organization’s assets becomes progressively more complex. While cloud service providers are responsible for securing their global infrastructure and protecting client databases from access by their own personnel, each cloud customer must implement its own measures to secure its users and data.



Security for Databases on the Cloud

Infrastructure Security Managed by Cloud Vendor

- Network security and monitoring
- OS, VM, container security and patches
- Database security patches and upgrades
- Compliance with regulations

Protection from the Cloud Vendor

- Administrative separation of duties
- Data encryption and Key Management
- Admin activity monitoring

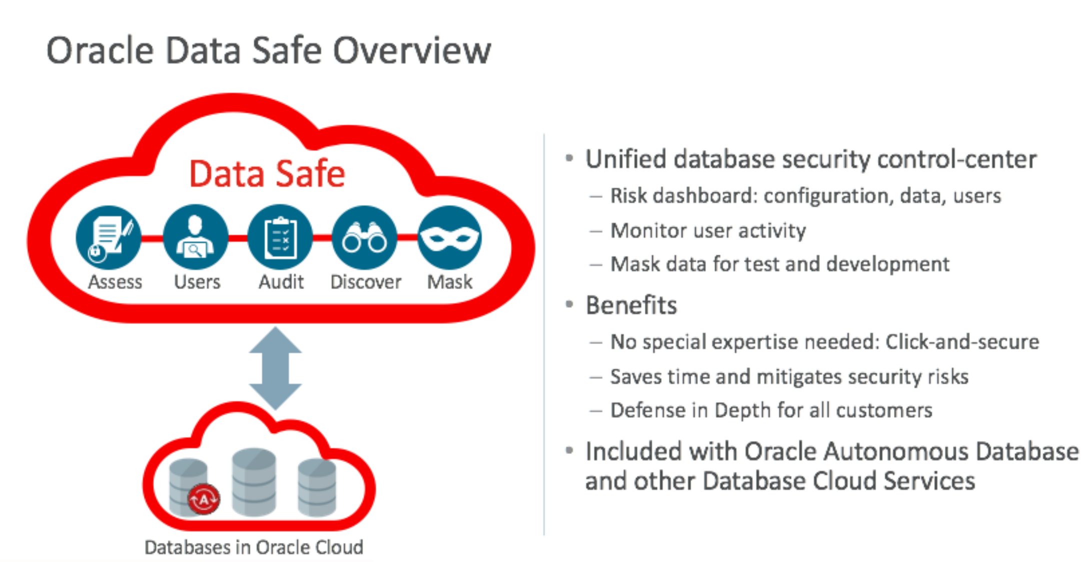
Customer Responsibility for their Security

- Configuration assessment
- User assessment
- Activity auditing
- Sensitive data discovery
- Data masking

For example, in an Infrastructure as a service (IaaS) environment, a cloud provider may secure cloud infrastructure, operating systems, and network services, but not the applications and users that access the data. Organizations are responsible for deciding what sensitive data goes into the database and which users can access it. This isn’t something that a cloud vendor can decide, as it is specific to each company’s industry, operations, customer base, and business goals.

To properly protect organizational data, it is necessary to first know how it’s configured, who is using it, and what types of sensitive data each database contains. It also means keeping track of who needs to access production data (versus sample, masked, or aggregate data), and putting a process in place for removing that data when it is no longer needed.

Oracle Data Safe is an important part of this multifaceted security strategy. It provides an integrated set of capabilities that will help you secure your users and configurations as well as meet data security compliance requirements. Oracle Data Safe is your single point of control for managing data security in the cloud.



Oracle Data Safe Overview

- Unified database security control-center
  - Risk dashboard: configuration, data, users
  - Monitor user activity
  - Mask data for test and development
- Benefits
  - No special expertise needed: Click-and-secure
  - Saves time and mitigates security risks
  - Defense in Depth for all customers
- Included with Oracle Autonomous Database and other Database Cloud Services

Oracle Data Safe provides a unified security control center for cloud databases

CONTROLLING ACCESS TO SENSITIVE DATA IN FIVE EASY STEPS

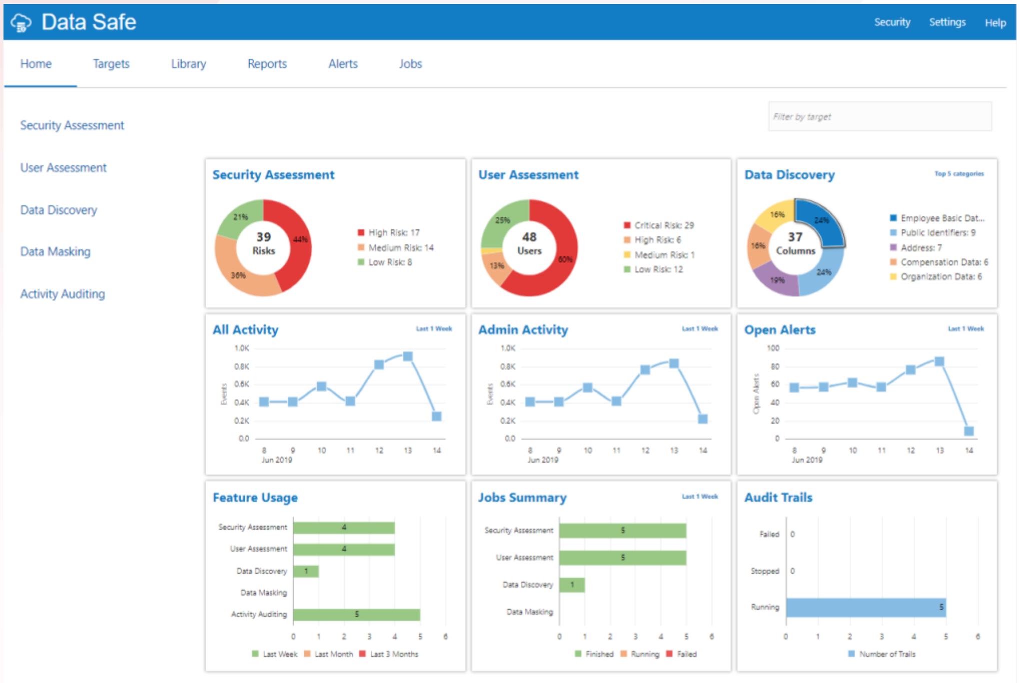
Enterprise databases frequently include large quantities of personal information, making them attractive targets for hackers who want to steal data and disrupt business practices. To mount a strong defense you need to know precisely *where* your sensitive data is located and *who* is accessing that data. In addition, knowing what risks are associated with your users and having the ability to audit activities are critical to a good security posture. Oracle Data Safe makes it easy to systematically complete these tasks with five inter-related components:

» Security Assessment
» User Assessment
» Activity Auditing
» Data Discovery
» Data Masking

Oracle Data Safe puts these five components together into a unified, user-friendly environment, so you don’t need multiple tools — and highly skilled database security experts — to protect your data. This popular service is available today for databases on Oracle Cloud Infrastructure.

Raise the Bar on Database Security with Data Safe

- Gain a complete view of database security from one cohesive environment
- No special expertise needed, and no need to stitch together many different tools
- Nothing to install and nothing to maintain

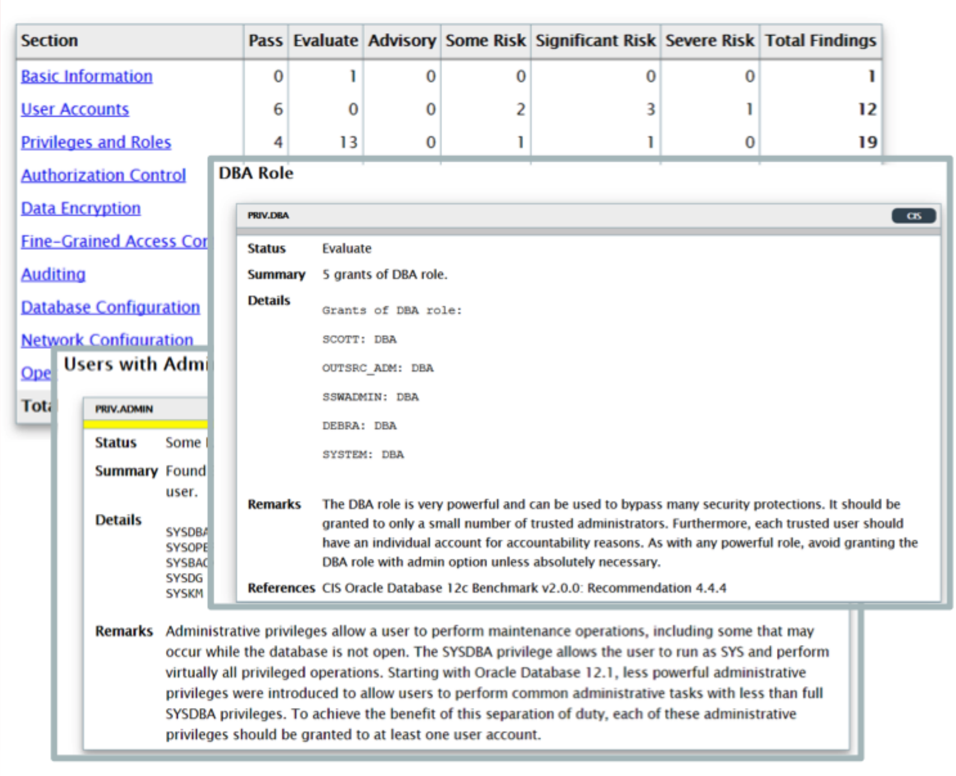


A unified security control center for Oracle Cloud Databases

Step 1: Security Assessment

A security assessment helps you determine if there are gaps in your configuration strategy, and offers guidance on how to remediate those gaps. The Security Assessment feature enables you to identify security vulnerabilities and to verify that encryption, auditing, and access controls have been implemented.

Oracle Cloud Database allows flexibility in how customers configure users, privileges, and security controls to meet different requirements. For example, the user and security controls implemented for a production system containing sensitive customer data might differ from those for a development system with synthetic test data. The Security Assessment feature of Oracle Data Safe enables you to examine security configuration parameters so you can implement the correct level of security and controls for each application. This might include, for example, identifying when default passwords are being used or when users have more privileges than they should. The findings and recommendations support both the European Union General Data Protection Regulation (EU GDPR) and the Center for Internet Security (CIS) benchmark.



Section	Pass	Evaluate	Advisory	Some Risk	Significant Risk	Severe Risk	Total Findings
Basic Information	0	1	0	0	0	0	1
User Accounts	6	0	0	2	3	1	12
Privileges and Roles	4	13	0	1	1	0	19
Authorization Control							
Data Encryption							
Fine-Grained Access Con							
Auditing							
Database Configuration							
Network Configuration							
Ope							
Tot							

DBA Role

PRIV.DBA — CIS

Status Evaluate

Summary 5 grants of DBA role.

Details

```
Grants of DBA role:

SCOTT: DBA

OUTSRC_ADM: DBA

SSWADMIN: DBA

DEBRA: DBA

SYSTEM: DBA
```

Remarks The DBA role is very powerful and can be used to bypass many security protections. It should be granted to only a small number of trusted administrators. Furthermore, each trusted user should have an individual account for accountability reasons. As with any powerful role, avoid granting the DBA role with admin option unless absolutely necessary.

References CIS Oracle Database 12c Benchmark v2.0.0: Recommendation 4.4.4

Users with Admi

PRIV.ADMIN

Status Some

Summary Found user.

Details

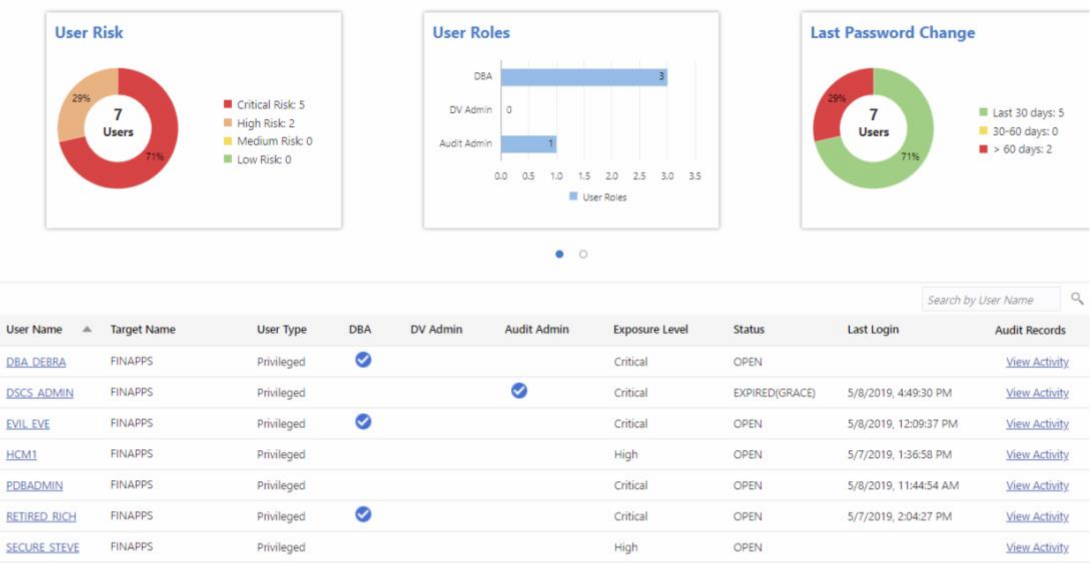
```
SYSDBA
SYSOPE
SYSBAC
SYSDG
SYSKM
```

Remarks Administrative privileges allow a user to perform maintenance operations, including some that may occur while the database is not open. The SYSDBA privilege allows the user to run as SYS and perform virtually all privileged operations. Starting with Oracle Database 12.1, less powerful administrative privileges were introduced to allow users to perform common administrative tasks with less than full SYSDBA privileges. To achieve the benefit of this separation of duty, each of these administrative privileges should be granted to at least one user account.

Use the Security Assessment to examine security parameters and implement application controls

Step 2: User Assessment

Oracle Data Safe includes user assessment and monitoring capabilities that help you pinpoint risks, especially associated with privileged users and accounts. You can now identify the database users who pose the highest risk if their accounts were to be compromised or if they were to go rogue and become bad actors. These accounts might require a higher level of monitoring or a possible reduction in privileges within the context of their roles. User Assessment reports help you quickly identify dormant accounts for locking or removal. Links from the User Assessment reports to the Activity Auditing function show the audited activities performed by the users.



User Name	Target Name	User Type	DBA	DV Admin	Audit Admin	Exposure Level	Status	Last Login	Audit Records
DBA_DEBRA	FINAPPS	Privileged	✓			Critical	OPEN		View Activity
DSCS_ADMIN	FINAPPS	Privileged			✓	Critical	EXPIRED(GRACE)	5/8/2019, 4:49:30 PM	View Activity
EVIL_EVE	FINAPPS	Privileged	✓			Critical	OPEN	5/8/2019, 12:09:37 PM	View Activity
HCM1	FINAPPS	Privileged				High	OPEN	5/7/2019, 1:36:58 PM	View Activity
PDBADMIN	FINAPPS	Privileged				Critical	OPEN	5/8/2019, 11:44:54 AM	View Activity
RETIRED_RICH	FINAPPS	Privileged	✓			Critical	OPEN	5/7/2019, 2:04:27 PM	View Activity
SECURE_STEVE	FINAPPS	Privileged				High	OPEN		View Activity

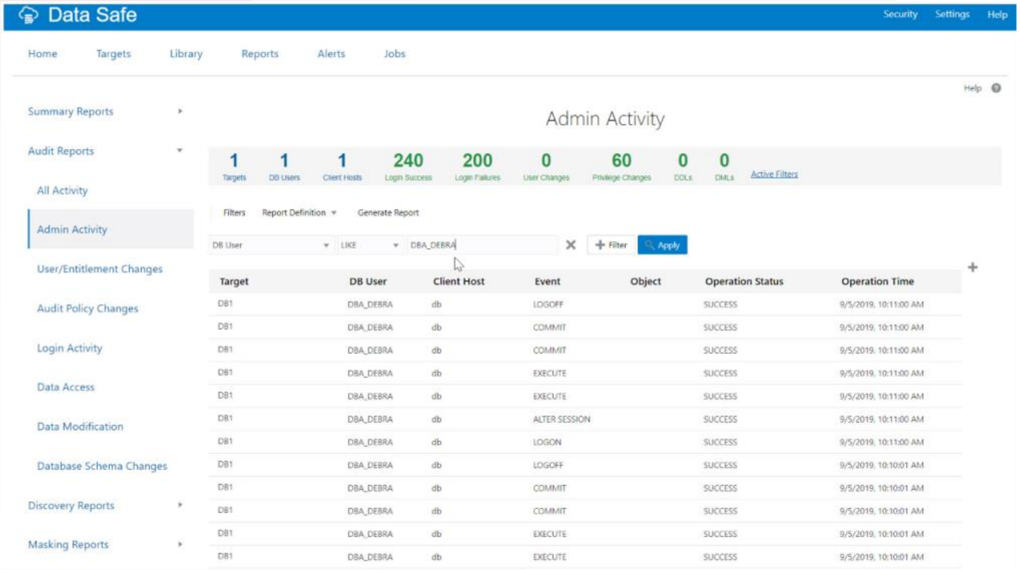
The User Assessment feature allows administrators to identify and evaluate privileged accounts

Step 3: Activity Auditing

With Data Safe Activity Auditing, you can monitor user activities on Oracle Cloud databases, collect and retain audit records per industry and regulatory compliance requirements, and trigger alerts for unusual activity. You can audit sensitive data changes, administrator and user activities, and other activities recommended by the Center for Internet Security. You can set up alerts when a database parameter or audit policy changes, a failed login by an admin occurs, user entitlements change, and when a user is created or deleted. The Oracle Database includes a number of pre-defined polices and any of these can be enabled through Data Safe with just a few clicks.

The Data Safe dashboard (shown on page 6) lets you quickly spot trends in activity, including alerts. From the dashboard, you can also check on the status of the audit trails (audit trails tell Data Safe where in the database to look for audit data) and see the overall auditing activity.

There are several activity auditing reports provided, such as, summary of events collected and alerts, all audited activities, audit policy changes, admin activity, login activity, database query operations, DDLs, DMLs, and user and entitlement changes. You can view the generated alerts and filter and search for them. Both alerts and audit data reports can be customized and saved or downloaded in PDF or XLS format.



1	1	1	240	200	0	60	0	0
Targets	DB Users	Client Hosts	Login Success	Login Failures	User Changes	Privilege Changes	DDLs	DMLs

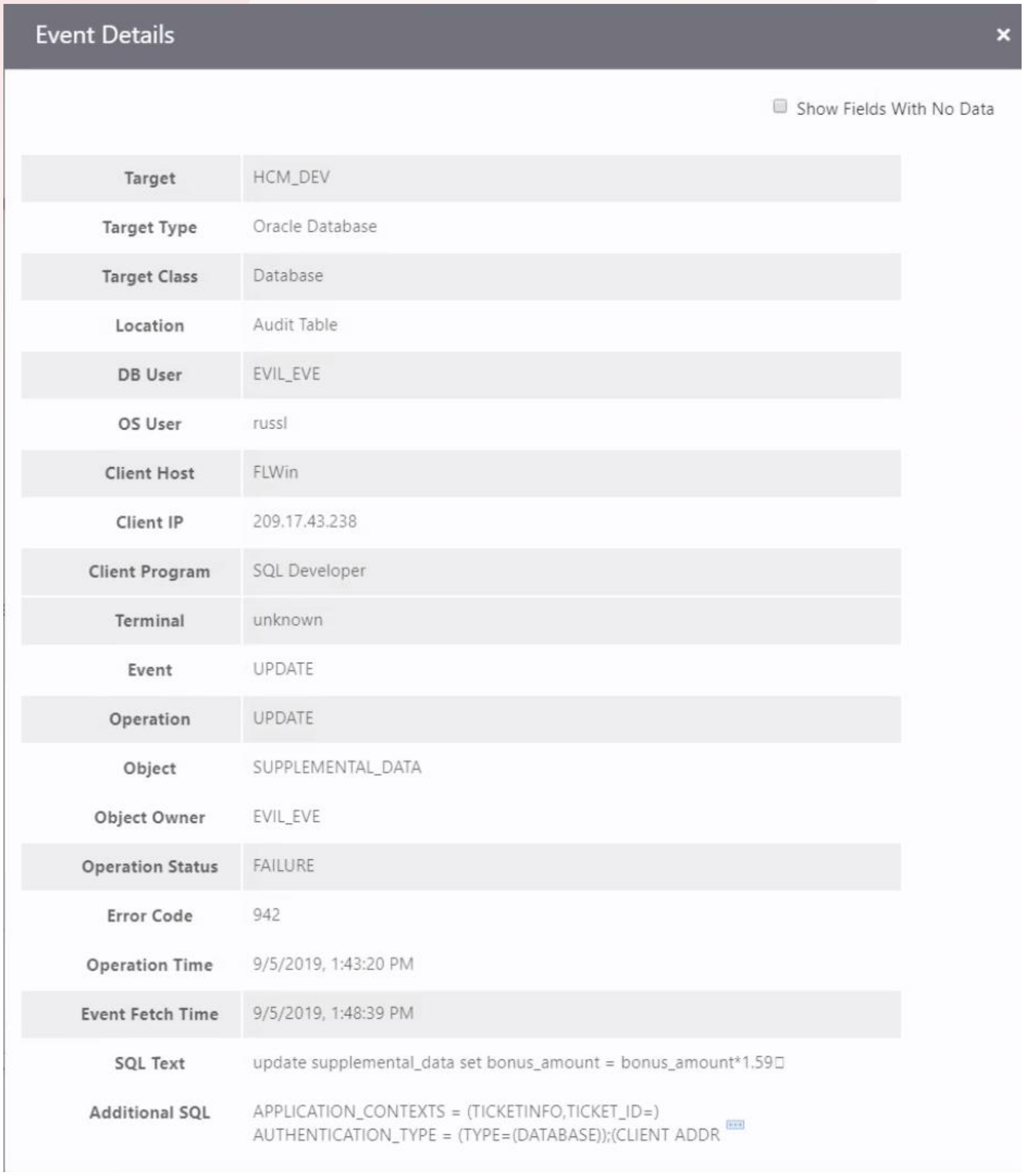
Active Filters

DB User LIKE DBA_DEBRA

Target	DB User	Client Host	Event	Object	Operation Status	Operation Time
DB1	DBA_DEBRA	db	LOGOFF		SUCCESS	9/5/2019, 10:11:00 AM
DB1	DBA_DEBRA	db	COMMIT		SUCCESS	9/5/2019, 10:11:00 AM
DB1	DBA_DEBRA	db	COMMIT		SUCCESS	9/5/2019, 10:11:00 AM
DB1	DBA_DEBRA	db	EXECUTE		SUCCESS	9/5/2019, 10:11:00 AM
DB1	DBA_DEBRA	db	EXECUTE		SUCCESS	9/5/2019, 10:11:00 AM
DB1	DBA_DEBRA	db	ALTER SESSION		SUCCESS	9/5/2019, 10:11:00 AM
DB1	DBA_DEBRA	db	LOGON		SUCCESS	9/5/2019, 10:11:00 AM
DB1	DBA_DEBRA	db	LOGOFF		SUCCESS	9/5/2019, 10:10:01 AM
DB1	DBA_DEBRA	db	COMMIT		SUCCESS	9/5/2019, 10:10:01 AM
DB1	DBA_DEBRA	db	COMMIT		SUCCESS	9/5/2019, 10:10:01 AM
DB1	DBA_DEBRA	db	EXECUTE		SUCCESS	9/5/2019, 10:10:01 AM
DB1	DBA_DEBRA	db	EXECUTE		SUCCESS	9/5/2019, 10:10:01 AM

Admin Activity Reports

Setting up Activity Auditing in Data Safe is a simple 3-step process: 1) Select the targets you want to audit 2) Provision audit policies specifying what audit information will be collected 3) Create audit trails that tell Data Safe from where to collect audit information.



□ Show Fields With No Data

Target	HCM_DEV
Target Type	Oracle Database
Target Class	Database
Location	Audit Table
DB User	EVIL_EVE
OS User	russl
Client Host	FLWin
Client IP	209.17.43.238
Client Program	SQL Developer
Terminal	unknown
Event	UPDATE
Operation	UPDATE
Object	SUPPLEMENTAL_DATA
Object Owner	EVIL_EVE
Operation Status	FAILURE
Error Code	942
Operation Time	9/5/2019, 1:43:20 PM
Event Fetch Time	9/5/2019, 1:48:39 PM
SQL Text	update supplemental_data set bonus_amount = bonus_amount*1.59□

Additional SQL	APPLICATION_CONTEXTS = (TICKETINFO,TICKET_ID=)
	AUTHENTICATION_TYPE = (TYPE=(DATABASE));(CLIENT ADDR …

Event Details

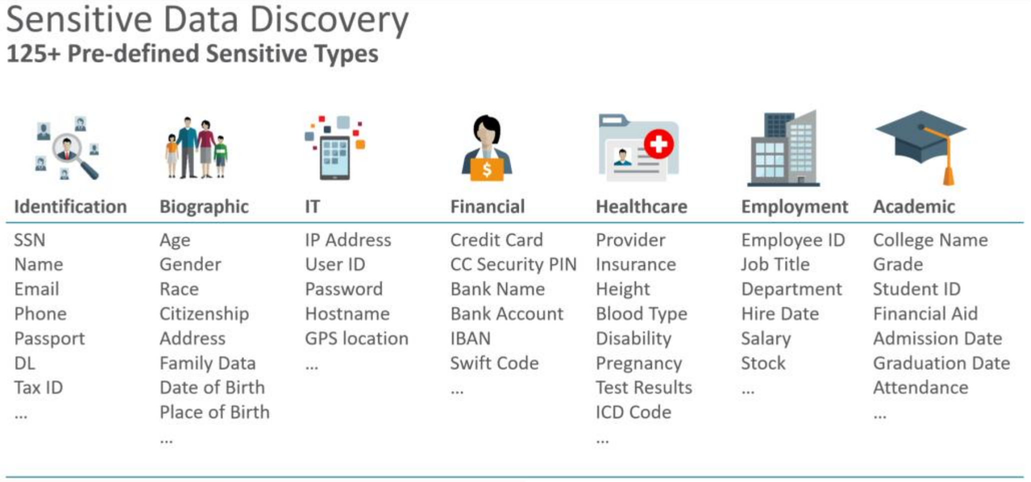
Once this is done, Data Safe automatically retrieves audit data and stores it in the secure Data Safe repository (separate from the database being monitored so it can't be deleted or altered). You can set up alerts on key events based on the predefined set of alerts available in Data Safe Activity Auditing. Interactive reports allow you to look at audit data, filter it as needed, and create scheduled reports to meet your security and compliance needs.

Step 4: Data Discovery

With multiple development teams and data distributed over multiple databases, it's not always easy to know where your sensitive data is. In order to protect your data, you need to understand what kind of sensitive data you have, how much of it you have, and where it resides. Sensitive Data Discovery helps

Many organizations don't really know how secure their databases are, how much sensitive data they have, or where their sensitive data is located.

you decide what to protect. It identifies and classifies 125+ sensitive types of data, such as PII, IT data, financial data, employment data, and health data.



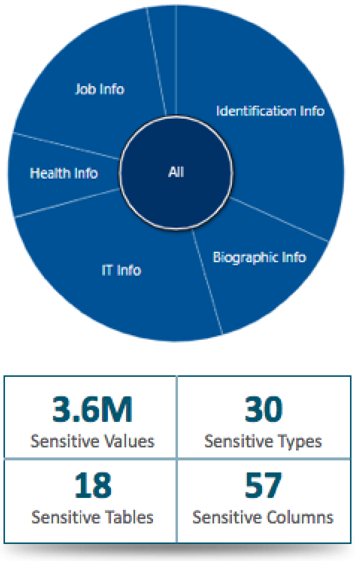
Sensitive Data Discovery

125+ Pre-defined Sensitive Types

Identification	Biographic	IT	Financial	Healthcare	Employment	Academic
SSN	Age	IP Address	Credit Card	Provider	Employee ID	College Name
Name	Gender	User ID	CC Security PIN	Insurance	Job Title	Grade
Email	Race	Password	Bank Name	Height	Department	Student ID
Phone	Citizenship	Hostname	Bank Account	Blood Type	Hire Date	Financial Aid
Passport	Address	GPS location	IBAN	Disability	Salary	Admission Date
DL	Family Data	…	Swift Code	Pregnancy	Stock	Graduation Date
Tax ID	Date of Birth		…	Test Results	…	Attendance
…	Place of Birth			ICD Code		…
	…			…		

The Data Discovery pre-defined sensitive data types

You can select the sensitive data categories that you want to discover, such as personally identifiable information or healthcare information. You can also easily define custom categories of new sensitive data types that match your organization’s requirements.

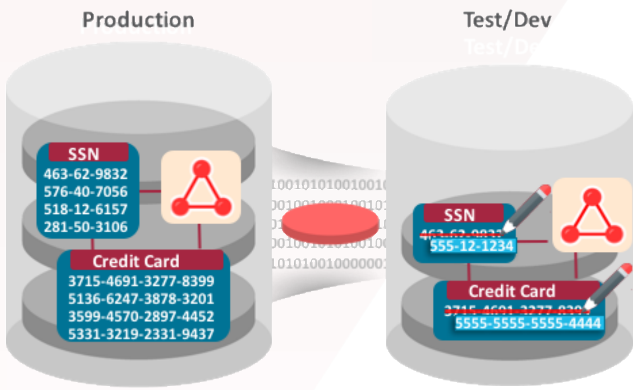


3.6M Sensitive Values	30 Sensitive Types
18 Sensitive Tables	57 Sensitive Columns

Data Discovery reports on sensitive data

Step 5: Data Masking

Being able to share production data with test and development teams helps you to improve the quality of your applications through real-world data. But copies of production systems carry all the sensitive data (and the risk associated with that data) into environments which are not as well protected as your production environments. Besides, the sensitive data such as credit card numbers are not really needed. This is where Data Masking comes in. Data Masking replaces sensitive data in an application database with fictitious but realistic values. You can then share those data sets with application developers, application testers, and partners. This gives them a realistic data set for testing and developing applications — without exposing sensitive data. As Data Masking is integrated with Data Discovery, a compatible masking format is automatically suggested for any discovered sensitive data. Data Safe lets you discover and mask sensitive data with just a few clicks.



Data masking reduces risk by obfuscating sensitive data.

The Data Masking feature of Oracle Data Safe uses the information discovered during the sensitive Data Discovery process to create data masking policies to protect, for example, social security numbers, credit card numbers, financial data, salary information, and personal health information. Data masking replaces real data with disguised, yet realistic, data within development, testing, and partner databases, and includes more than 50 predefined masking formats.

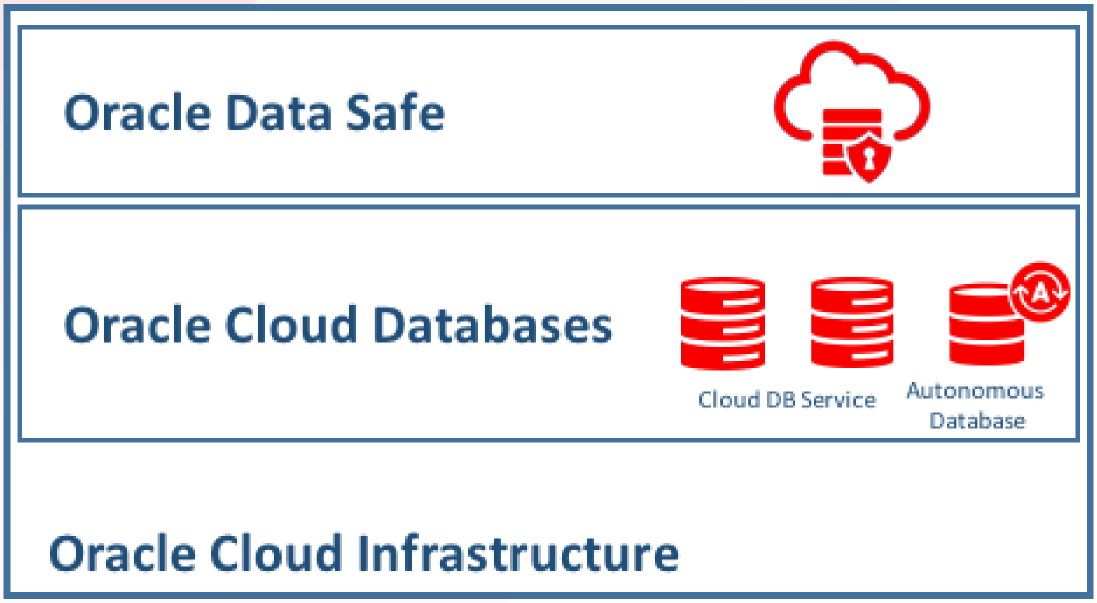
Data Masking maintains relational integrity with support for shuffle masking, conditional masking, compound masking, SQL expression masking, user-defined masking, and other masking formats.

A HYPOTHETICAL SCENARIO INVOLVING SENSITIVE PATIENT DATA

Consider a database used by a healthcare organization to store the results of diagnostic test results. With Oracle Data Safe, the security team can assess the database configuration (including password policies, parameter settings, and patch levels) to ensure the database is configured according to best practices. They can then quickly assess database users to identify which users have privileges that make them most at risk for inappropriate access to data, and configure audit policies to monitor their database activity. They can use sensitive Data Discovery to scan the database to identify which schemas, tables and columns contain sensitive patient data. When copies of the database are made for test and development or partners, they can now automatically replace sensitive data with realistic looking trials data. And they can do all of this from a single console in just a few minutes.

BRINGING IT ALL TOGETHER

Data Safe runs on the Oracle Cloud Infrastructure and is a key part of an over-arching security strategy that runs from the infrastructure itself to our latest self-securing Oracle Autonomous Database. In the following sections, we'll explore this relationship in more detail.



The relationship of Oracle Data Safe to Autonomous Database and Oracle Cloud Infrastructure

Oracle handles a number of crucial security concerns for its cloud customers automatically, including the following:

- Network security and monitoring
- OS and platform security
- Database patches and upgrades
- Administrative separation of duties
- Data encryption by default

BETTER DATABASE SECURITY WITH ORACLE AUTONOMOUS DATABASE

Oracle Data Safe extends the self-securing capabilities of the Oracle Autonomous Database to protect data while it's in use and to continuously monitor the users who access that data. We have a multi-pronged strategy to protect your data and free DBAs to focus on high-value tasks such as understanding their data and instituting proper protections and controls.

Oracle Autonomous Database is a revolutionary cloud service that simplifies database administration and tuning tasks, including automatically maintaining security configurations. For example, by automatically applying patches in a rolling fashion across the nodes of a cluster, Oracle Autonomous Database secures itself without application downtime. Security patches are applied every quarter or as needed to the firmware, operating system, clusterware, and database — with no downtime.

Oracle Autonomous Database includes AI and machine learning technology to protect your database management systems from both external attacks and malicious internal users. For example, the database can apply security patches automatically, without downtime.

Patching is just part of the picture. The database also protects itself with always-on encryption. Encryption protects your data in situations where a breach allows a hacker to access the data blocks directly. This practice ensures that even if database files with sensitive data are copied, they are useless to cybercriminals. Oracle Autonomous Database encrypts customer data while it is in motion, at rest, and in backups.

By liberating database administrators from the daily repetitive management chores such as database tuning, patching, and backups, Oracle Autonomous Database allows DBAs to focus on high-value tasks such as application management, and keeping sensitive data secure.

SECURITY AT MULTIPLE LAYERS WITH ORACLE CLOUD INFRASTRUCTURE

Oracle secures today’s complex database environments with an intelligent, cloud-based platform that prevents, detects, and rapidly responds to security threats.

For example, Oracle Cloud Infrastructure is based on seven core pillars to ensure customers have the isolation, data protection, control, and visibility required for a robust cloud infrastructure. Oracle’s machine learning algorithms add intelligence to security operations center (SOC) activities and a cloud access security broker (CASB) automatically detects threats to cloud applications. At the edge, Oracle security services include distributed denial of service (DDoS) Protection and a web application firewall to defend against internet-based threats. Finally, Oracle assumes the responsibility of protecting your infrastructure with a highly trained, 24/7 network operations center (NOC) staff. Oracle's security technology, process, and operations reduce the risk, cost, and complexity of moving to the cloud. With multiple layers of defense, Oracle combats cyber threats with core-to-edge cloud services that secure your data and thwart cyber threats.

CONCLUSION

As databases move to the cloud, enterprises need to proactively monitor how their data is managed and accessed, and by whom it is used. While cloud providers secure your infrastructure and the platform services, it's up to you to secure your applications, users, and data. The Oracle Data Safe cloud service integrates all of your security needs including assessing your configuration and users, auditing user activity for compliance, and identifying sensitive data for masking — all through a single dashboard that allows you to quickly and easily secure your data assets.

To learn more about Oracle Database Security, visit:
http://www.oracle.com/database/technologies/security/data-safe.html

ORACLE CORPORATION

Worldwide Headquarters
500 Oracle Parkway, Redwood Shores, CA 94065 USA

Worldwide Inquiries
TELE + 1.650.506.7000 + 1.800.ORACLE1
FAX + 1.650.506.7200
oracle.com

CONNECT WITH US

Call +1.800.ORACLE1 or visit oracle.com. Outside North America, find your local office at oracle.com/contact.

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