ORACLE

# Oracle Autonomous Database Security Features

March 2020

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& Cloud Technologies

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# Safe harbor statement

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# Agenda

- Encryption (Data, Backup, Connections)
- Network Access Control
- System & Data Protection
- Sensitive Data Discovery & Masking
- Auditing

# Data | Your Most Valuable Asset

# Examples of where data was not very well protected

Mar 2020: Unsecured Database Exposed 8 Million UK Shoppers Records

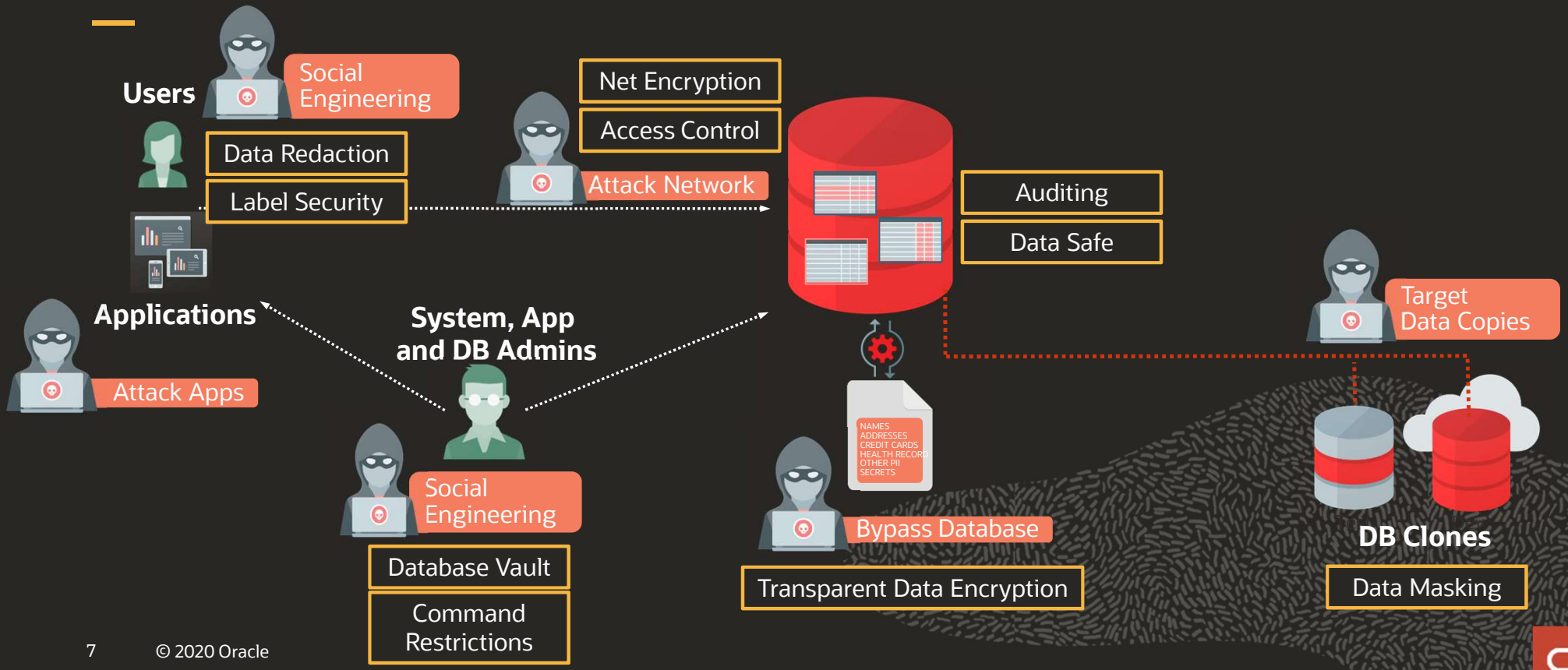
Jul 2019: records of more than 5 million Bulgarians got stolen by hackers from the country's tax revenue office

Jul 2019: hacker gained access to 100 million Capital One credit card applications and accounts

Nov 2018: Marriott said the Starwood guest reservation database was breached, potentially exposing information on about 500 million guests

https://latesthackingnews.com/2020/03/16/unsecured-database-exposed-8-million-uk-shoppers-records/
https://edition.cnn.com/2019/07/21/europe/bulgaria-hack-tax-intl/index.html
https://edition.cnn.com/2019/07/29/business/capital-one-data-breach/index.html
https://www.cnbc.com/2018/11/30/marriott-says-its-starwood-database-was-breached-onapproximately-500-million-guests-.html

# Database in focus



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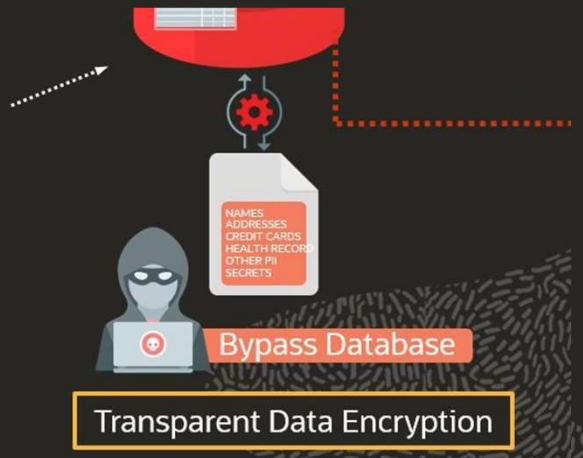

# Encryption | Transparent Data Encryption (TDE)

- Encryption of Application Data on media
- Enabled by default
- Encryption keys are managed automatically

```
SELECT * FROM v$encrypted_tablespaces;
```

| | TS# | ENCRYPTIONALG | ENCRYPTEDTS | ENCRYPTEDKEY | MASTERKEYID | BLOCKS_ENCRYPTED | BLOCKS_DECRYPTED | KEY_VERSION | STATUS | CON_ID |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4 | AES128 | YES | B00E5C527150F... | 774C2999B80... | 1551 | 1460 | 0 | NORMAL | 96 |
| 2 | 5 | AES128 | YES | B17AC4144AC66... | 774C2999B80... | 458 | 441 | 0 | NORMAL | 96 |

# Encryption | Transparent Data Encryption (TDE)

```
[oracle@hostfraee datafile]$ strings o1_mf_system_h6doz8nv_.dbf | grep -i Firstname
getFirstNamespaceNode
m_firstName
getFirstName
%Firstname5 Lastname5 Account 87654321
%Firstname4 Lastname4 Account 87654321
%Firstname3 Lastname3 Account 87654321
%Firstname2 Lastname2 Account 87654321
%Firstname1 Lastname1 Account 87654321
```

Without TDE

```
[oracle@hostfraee datafile]$ strings o1_mf_users_h6dp31c7_.dbf | grep -i Firstname
[oracle@hostfraee datafile]$ strings o1_mf_users_h6dp31c7_.dbf | more
8iJk#0
6K":
u*C=
i6bY
_[sr
Fc}j
gl||
a:9;
E2xS
```

With TDE

In the event that the storage media or data file is stolen, it is not possible to read the data

# Encryption | Backups

All Backups are encrypted

```
SQL> SELECT count(*) FROM v$backup_set_details WHERE encrypted = 'YES';

  COUNT(*)
----------
      1985

SQL> SELECT count(*) FROM v$backup_set_details WHERE encrypted = 'NO';

  COUNT(*)
----------
         0
```

# Encryption | SQL*Net Connections

All connections **MUST** use TCP/IP + SSL (TCPS)

Customer's responsibility
- Store wallet files in a secure location
- Share wallet files only with authorized users

```
WALLET_LOCATION = (SOURCE = (METHOD = file)
SSL_SERVER_DN_MATCH=ON
SSL_CLIENT_AUTHENTICATION=FALSE
```

```
SQL*Plus: Release 19.0.0.0.0 - Production
Version 19.3.0.0.0

Copyright (c) 1982, 2019, Oracle.  All ric

ERROR:
ORA-28860: Fatal SSL error
```

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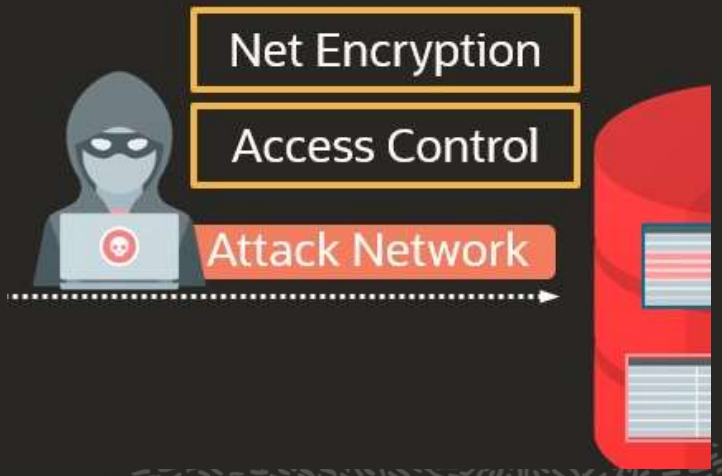
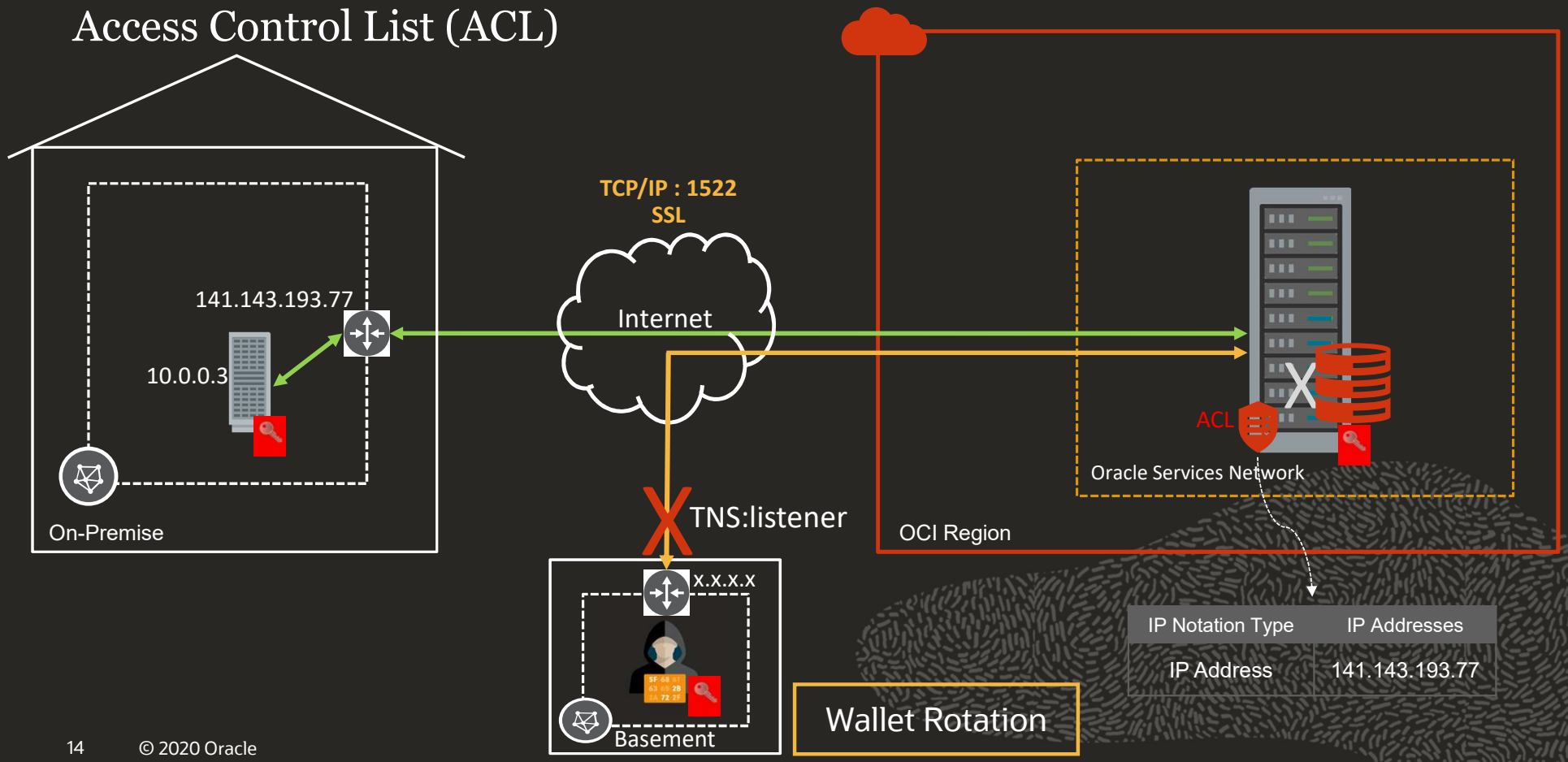


# Access Control List (ACL)



# Access Control List (ACL)

```
[opc@admin-interactivetech ~]$ ./connATPshared.sh

SQL*Plus: Release 18.0.0.0.0 - Production on Tue Mar 10 01:52:37 2020
Version 18.5.0.0.0

Copyright (c) 1982, 2018, Oracle.  All rights reserved.

Last Successful login time: Tue Mar 10 2020 01:34:37 +00:00

Connected to:
Oracle Database 18c Enterprise Edition Release 18.0.0.0.0 - Production
Version 18.4.0.0.0

SQL>
```

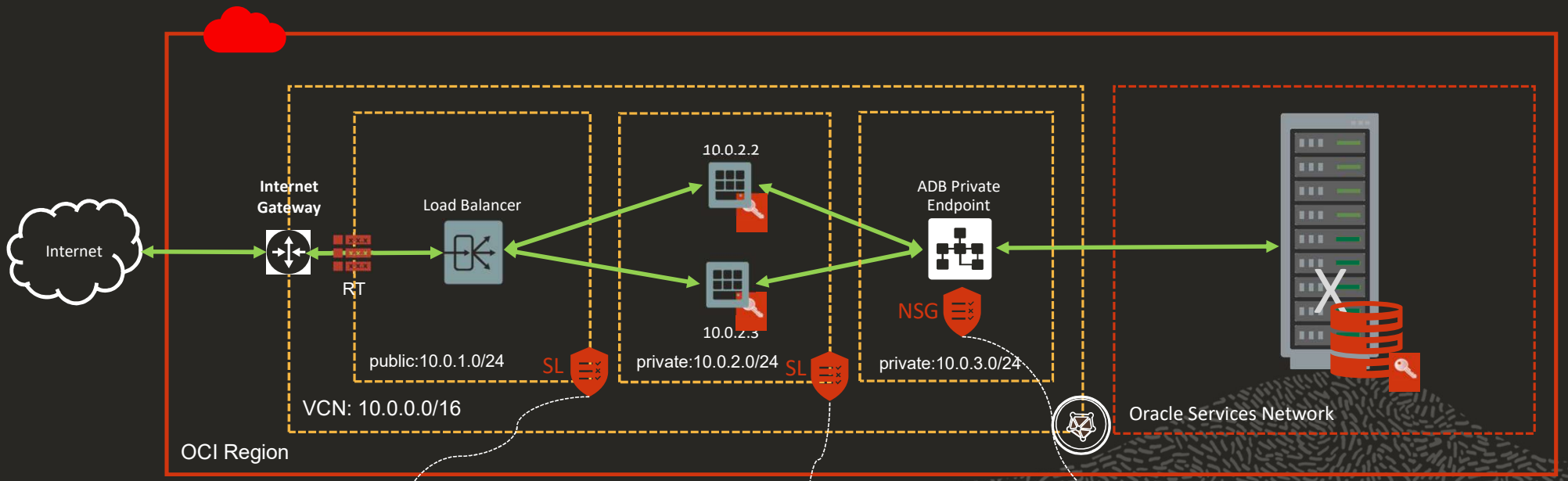
Without ACL

```
[opc@admin-interactivetech ~]$ ./connATPshared.sh

SQL*Plus: Release 18.0.0.0.0 - Production on Tue Mar 10 01:57:29 2020
Version 18.5.0.0.0

Copyright (c) 1982, 2018, Oracle.  All rights reserved.

ERROR:
ORA-12506: TNS:listener rejected connection based on service ACL filtering
```

With ACL

# Private Endpoints & Network Security Groups

https://www.linkedin.com/pulse/implement-private-endpoint-your-autonomous-database-sinan-petrus-toma/




| Rule | Stateless | Source |
|---|---|---|
| Ingress | No | 0.0.0.0/0 |
| Egress | No | 10.0.2.0/24 |

| Rule | Stateless | Source |
|---|---|---|
| Ingress | No | 10.0.1.0/24 |
| Egress | No | 10.0.3.0/24 |

| Rule | Stateless | Source |
|---|---|---|
| Ingress | No | 10.0.2.0/24 |

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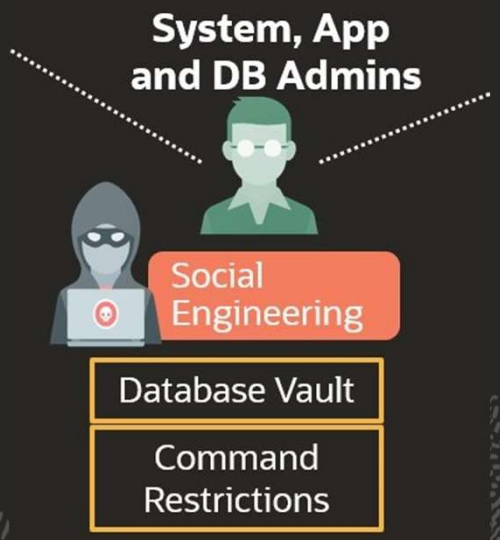

# Database Vault

- Stolen privileged user credentials are one of the most common attack vectors used by hackers
- Database Vault restricts access to application data by privileged users
  - Prevent malicious or accidental changes that disrupt operations by privileged users
  - Reduce the risk of insider and outside threats
  - Address compliance with data privacy laws and standards such as the EU General Data Protection Regulation (GDPR)

```
SQL> SELECT * FROM DBA_DV_STATUS;

NAME                 STATUS
-------------------- ------------
DV_CONFIGURE_STATUS  TRUE
DV_ENABLE_STATUS     TRUE
```

# Database Vault

```
SELECT firstname, lastname, email, position, location FROM hr_data.demo_hr_employees;
```

| FIRSTNAME | LASTNAME | EMAIL | POSITION | LOCATION |
|---|---|---|---|---|
| jeroen | krabe | jeroen.krabe@mycompany.com | DBA | New York |
| Frank | Stok | Frank.Stok@mycompany.com | Project Director | Santa Clara |
| Martijn | Krabe | Martijn.Krabe@mycompany.com | DBA | Santa Clara |
| John | Forde | John.Forde@mycompany.com | DBA | New York |
| joop | kaptijn | joop.kaptijn@mycompany.com | DBA | New York |

Without DB Vault

```
SELECT firstname, lastname, email, position, location FROM hr_data.demo_hr_employees;
```

```
ORA-01031: insufficient privileges
01031. 00000 - "insufficient privileges"
*Cause:    An attempt was made to perform a database operation without
           the necessary privileges.
*Action:   Ask your database administrator or designated security
           administrator to grant you the necessary privileges
```

With DB Vault

# High Privileges Restrictions

No OS/root logon or SYSDBA privileges

Prevent installing or modifying any software on the system

```
SQL> GRANT sysdba TO admin;
GRANT sysdba TO admin
*
ERROR at line 1:
ORA-01031: insufficient privileges
```

# SQL Command Restrictions

```
SQL> ADMINISTER KEY MANAGEMENT SET KEYSTORE close;
ADMINISTER KEY MANAGEMENT SET KEYSTORE close
*
ERROR at line 1:
ORA-01031: insufficient privileges
```

Disable Encryption

```
SQL> ALTER PROFILE default LIMIT failed_login_attempts UNLIMITED;
ALTER PROFILE default LIMIT failed_login_attempts UNLIMITED
*
ERROR at line 1:
ORA-01031: insufficient privileges
```

Unlimited Failed Logins

```
SQL> DROP TABLESPACE data INCLUDING CONTENTS;
DROP TABLESPACE data INCLUDING CONTENTS
*
ERROR at line 1:
ORA-01031: insufficient privileges
```

Drop Tablespace

# Agenda

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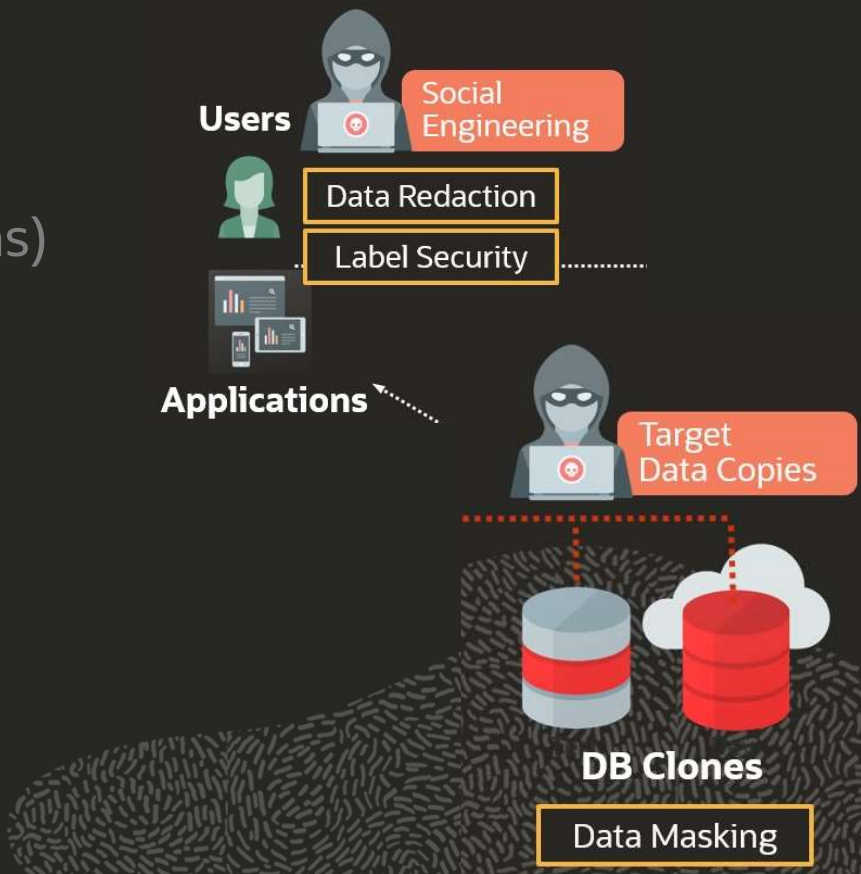


# Data Redaction

- Mask (redact) data that is returned from queries issued by applications
- Redaction at runtime! Data itself is not changed!
- Redaction of Credit card, personal IDs, birth dates
- comply with industry regulations such as Payment Card Industry Data Security Standard (PCI DSS) and the Sarbanes-Oxley Act.
- Policies can be implemented by the customer

# Data Redaction

```
SQL> SELECT * FROM admin.payment_details ORDER BY id;

CUSTOMER_ID CARD_STRING         EXPIRY_DA   SEC_CODE
----------- ------------------- --------- ----------
       4000 1234-1234-1234-1234 10-MAR-21         123
       4001 2345-2345-2345-2345 10-MAR-21         234
       4002 3456-3456-3456-3456 10-MAR-21         345
       4003 4567-4567-4567-4567 10-MAR-21         456
       4004 5678-5678-5678-5678 10-MAR-21         567
```

Without Data Redaction

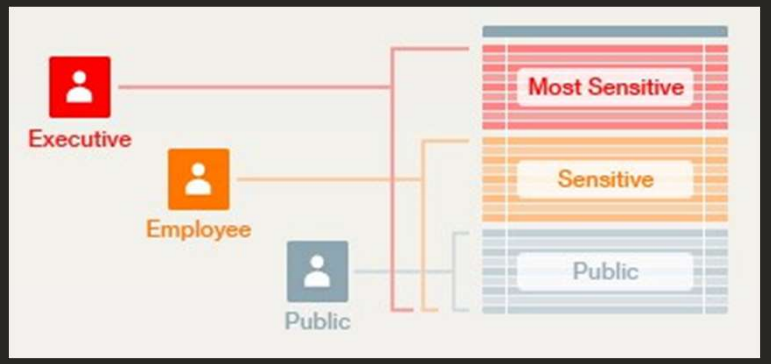
```
SQL> SELECT * FROM admin.payment_details ORDER BY id;

CUSTOMER_ID CARD_STRING         EXPIRY_DA   SEC_CODE
----------- ------------------- --------- ----------
       4000 ####-####-####-1234 10-MAR-21         123
       4001 ####-####-####-2345 10-MAR-21         234
       4002 ####-####-####-3456 10-MAR-21         345
       4003 ####-####-####-4567 10-MAR-21         456
       4004 ####-####-####-5678 10-MAR-21         567
```

With Data Redaction

# Oracle Label Security (OLS)

Label their data using different sensitivity levels

Users are allowed to access only those data records with the correspondent sensitivity level




```
SQL> SELECT STATUS FROM DBA_OLS_STATUS WHERE NAME = 'OLS_CONFIGURE_STATUS';

STATU
-----
TRUE
```

# Oracle Label Security (OLS)

Without OLS – All Users

```
SQL> select first_name, last_name, region
from customers;  2

FIRST_NAME LAST_NAME  REGION
---------- ---------- ----------
Harry      Hill       NORTH
Vic        Reeves     NORTH
Bob        Mortimer   WEST
Paul       Whitehouse SOUTH
Harry      Enfield    EAST
Jenifer    Lopez      WEST
```

```
SQL> select first_name, last_name, region
from customers;  2

FIRST_NAME LAST_NAME  REGION
---------- ---------- ----------
Harry      Hill       NORTH
Vic        Reeves     NORTH
Kylie      Minogue    NORTH
Thom       Yorke      NORTH
```

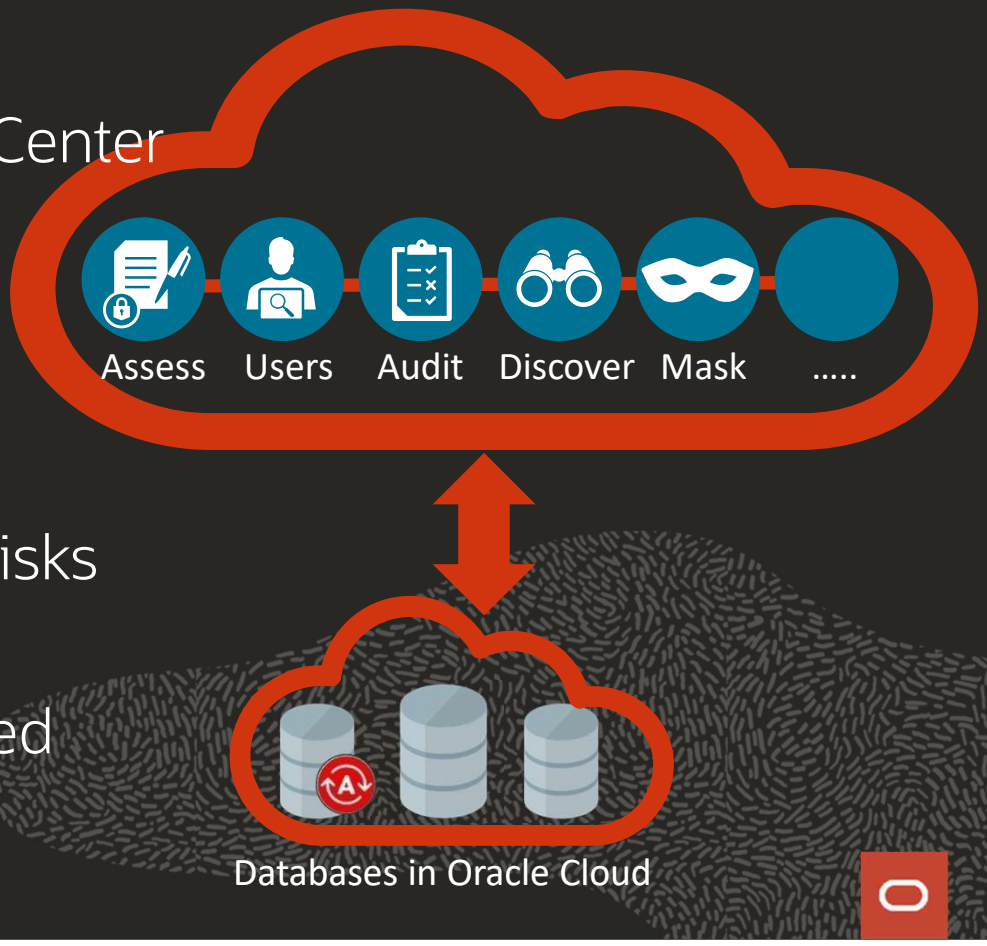
With OLS – User 1

```
SQL> select first_name, last_name, region
from customers;  2

FIRST_NAME LAST_NAME  REGION
---------- ---------- ----------
Bob        Mortimer   WEST
Jenifer    Lopez      WEST
Maria      Carey      WEST
Gareth     Gates      WEST
```

With OLS – User 2

# Data Safe

- Unified Database Security Control Center
  - Security Assessment
  - User Assessment
  - User Activity Auditing
  - Sensitive Data Discovery
  - Sensitive Data Masking
- Saves time and mitigates security risks
- Defense in Depth for all customers
- No special security expertise needed



# Data Masking

# Agenda

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# Database Auditing

- Selective and effective auditing inside the Database using policies and conditions
- Predefined policies to monitor any abnormal activity
- Additional audit policies can be configured to audit based on specific IP addresses, programs, time periods, or connection types
- Enabled by default
- Can NOT be disabled!

# Database Auditing

```
SQL> SELECT value
FROM v$option
WHERE parameter = 'Unified Auditing';
  2    3
VALUE
----------------------------------------
TRUE
```

```
SELECT * FROM audit_unified_policies ORDER BY policy_name, audit_option;
```

t Output x | Query Result x

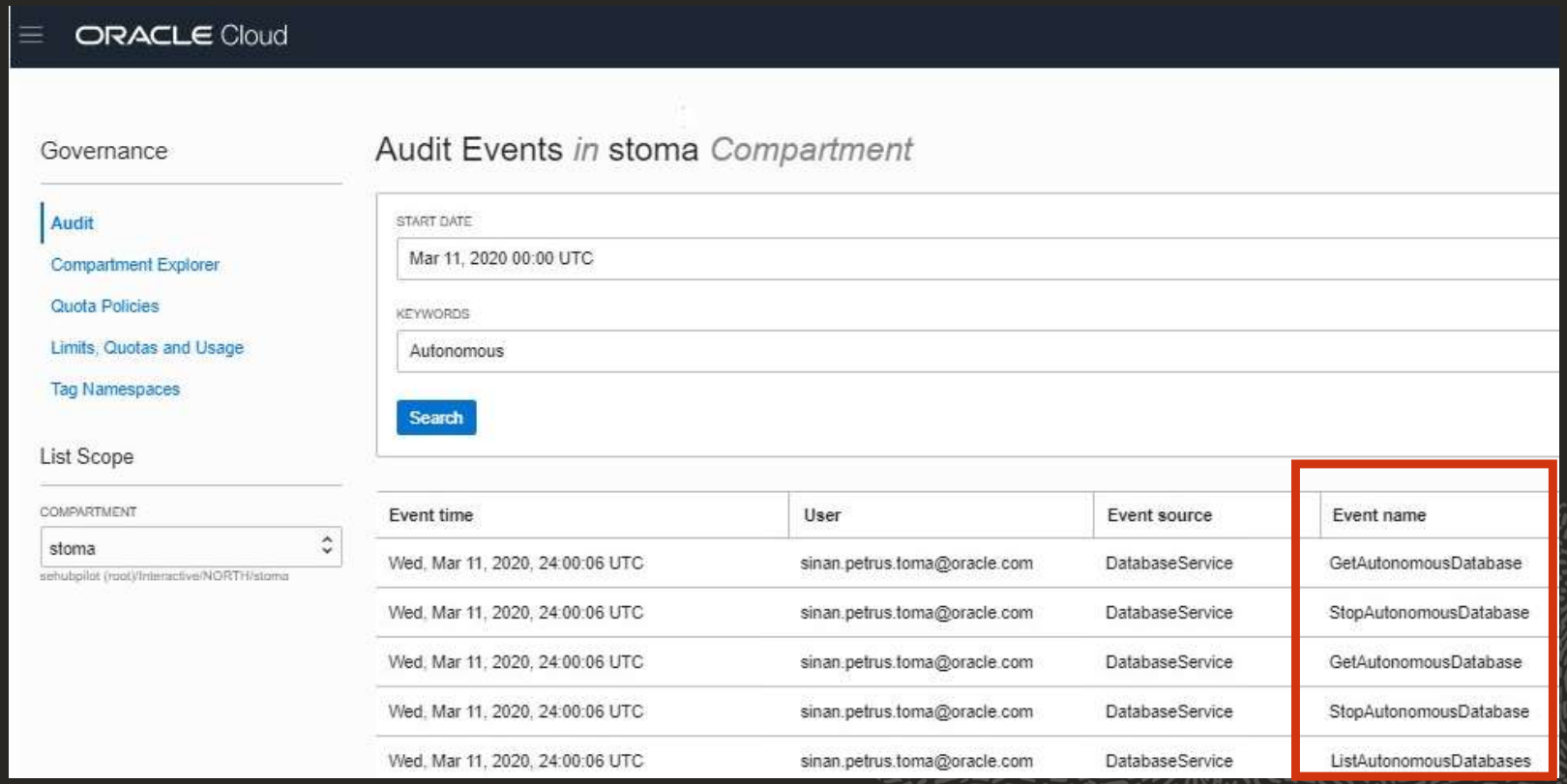
SQL | Fetched 50 rows in 2.221 seconds

| POLICY_NAME | AUDIT_CO... | CONDITIO... | AUDIT_OPTION | AUDIT_OPTION_TYPE |
|---|---|---|---|---|
| ADB_ADMIN_AUDIT | NONE | NONE | ALTER USER | STANDARD ACTION |
| ADB_ADMIN_AUDIT | NONE | NONE | CHANGE PASSWORD | STANDARD ACTION |
| ADB_MANDATORY_AUDIT | NONE | NONE | EXECUTE | OBJECT ACTION |
| ADB_MANDATORY_AUDIT | NONE | NONE | EXECUTE | OBJECT ACTION |
| COMMON_USER | NONE | NONE | ALL | STANDARD ACTION |
| ORA_ACCOUNT_MGMT | NONE | NONE | ALTER ROLE | STANDARD ACTION |
| ORA_ACCOUNT_MGMT | NONE | NONE | ALTER USER | STANDARD ACTION |

```
SELECT event_timestamp, dbusername, os_username, userhost, client_program_name, action_name, sql_text
FROM unified_audit_trail
ORDER BY event_timestamp desc;
```

| NT_TIMESTAMP | DBUSERNAME | OS_USERNAME | USERHOST | CLIENT_PROGRAM_NAME | ACTION_NAME | SQL_TEXT |
|---|---|---|---|---|---|---|
| AR-20 11.27.14.162204000 AM | C##CLOUD$SERVICE | oracle | wls-1.subapp0.v... | JDBC Thin Client | ALTER USER | ALTER USER OML$PROXY IDENTIFIED BY * |
| AR-20 11.23.06.589680000 AM | C##CLOUD$SERVICE | oracle | wls-3.subapp2.v... | JDBC Thin Client | ALTER USER | ALTER USER CVA_OML GRANT CONNECT THROUGH OML$PROXY |
| AR-20 04.06.16.232866000 AM | ADMIN | opc | admin-interacti... | sqlplus@admin-inter... | EXECUTE | begin DBMS_CLOUD.PUT_OBJECT('OBJ_STORE_CRED','https://swiftobjectstor.. |
| AR-20 04.06.15.809551000 AM | ADMIN | oracle | el0pod-8tlgg7.s... | oracle@el0pod-8tlgg... | DELETE | DELETE FROM LBACSYS.OLS$POLT WHERE TBL_NAME = :B2 AND OWNER = :B1 |
| AR-20 03.30.12.536690000 PM | CHRISTELLE | cvaltanc | CVALTANC-ES | SQL Developer | LOGON | (null) |

# API Audit Logs



# API Audit Logs

- Audit provides records of API operations performed against supported services
- Audit logs are maintained for 90 days
- Can be configured for up to 365 days

# VCN Flow Logs

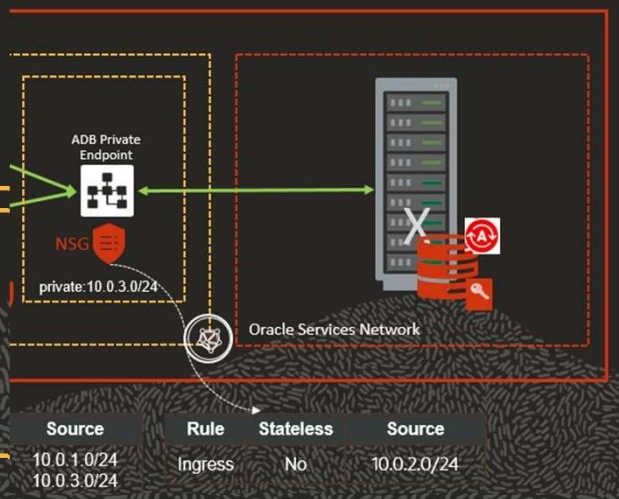
View connection information for traffic within your VCN

Keeps detailed records of every flow that passes through your VCN and presents this data for analysis

- Source and destination of the traffic
- Quantity of traffic
- Permit or Deny action taken

Information can be used for:

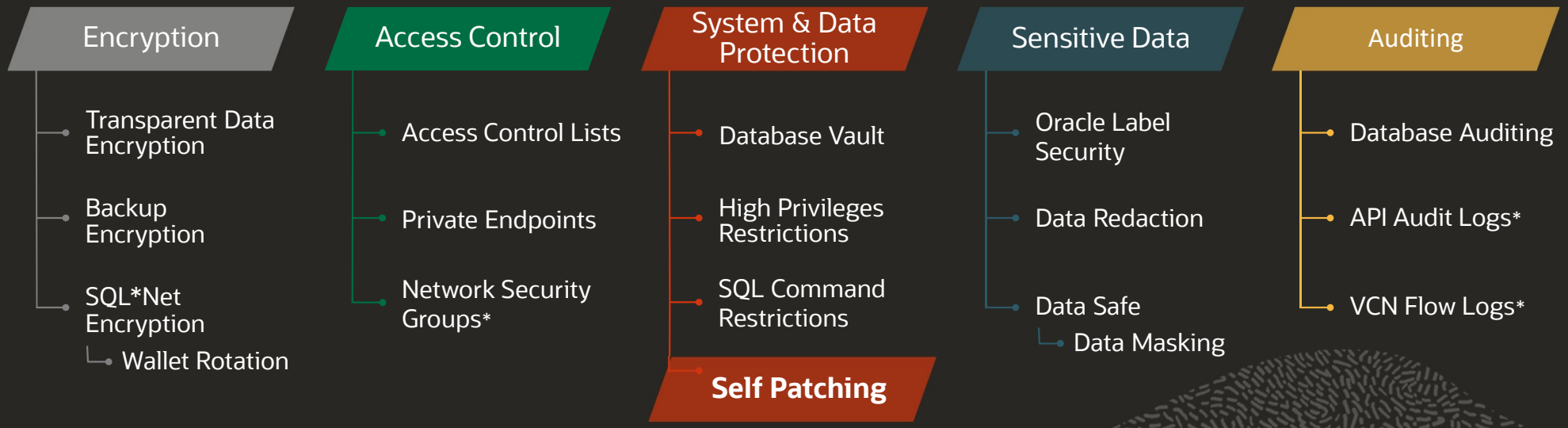
- Network monitoring
- Troubleshooting
- Compliance



# OCI Compliance: Current Audit Programs

| | | | | | | |
|---|---|---|---|---|---|---|
| Global | SOC 1 : SOC 2 : SOC 3 | 27001 : 27017 : 27018 | Self-Assessment | US Privacy Shield | | |
| Government | DoD DISA SRG IL2 | Moderate – Agency ATO | VPAT – Section 508 | G-Cloud 11 - UK | Model Clauses - EU | |
| Industry | HIPAA | PCI DSS Level 1 | FISC - Japan | IG Toolkit - UK | | |
| Regional | GDPR - EU | BSI C5 - Germany | TISAX - Germany | PIPEDA - Canada | Cyber Essentials Plus - UK | My Number - Japan | Cloud Security Principles - UK |

# Autonomous Database | Security Features




* OCI Security Features

# 85%

of security breaches occurred
after the CVE was published*


**Autonomous**

- No Downtime
- Applied Immediately
- No Customer Interaction

**On-Premise**

- Downtime Restrictions
- Takes Long Time
- Human Resources

* Verizon - 2018 Data Breach Investigation Report

# Security is Shared Responsibility

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

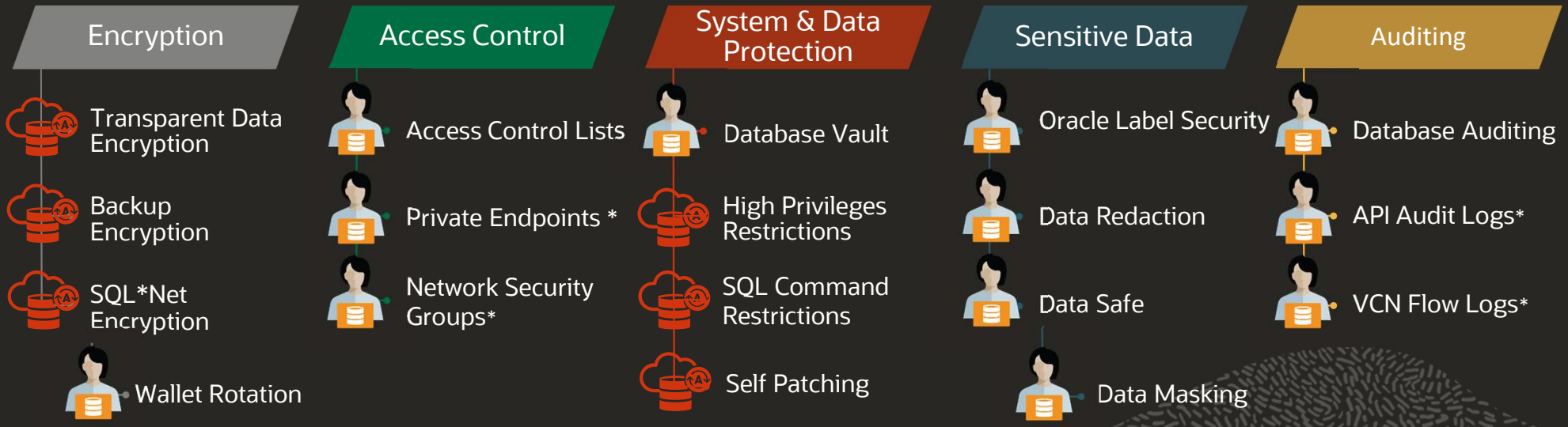
Oracle Responsibility

- Ongoing security assessments
- Users and privileges
- Sensitive data discovery
- Data protection
- Activity auditing

Customer Responsibility

Tools provided by Oracle

# Autonomous Database | Security Features




* OCI Security Features

# Further Reads

https://blogs.oracle.com/cloud-infrastructure/getting-up-to-speed-on-using-private-endpoints-for-autonomous-database-with-shared-exadata-infrastructure

https://blogs.oracle.com/oraclemagazine/getting-started-with-autonomous-database-security

https://blogs.oracle.com/oraclemagazine/autonomous-and-secure

https://www.oracle.com/a/ocom/docs/database/oracle-autonomous-database-strategy-wp.pdf

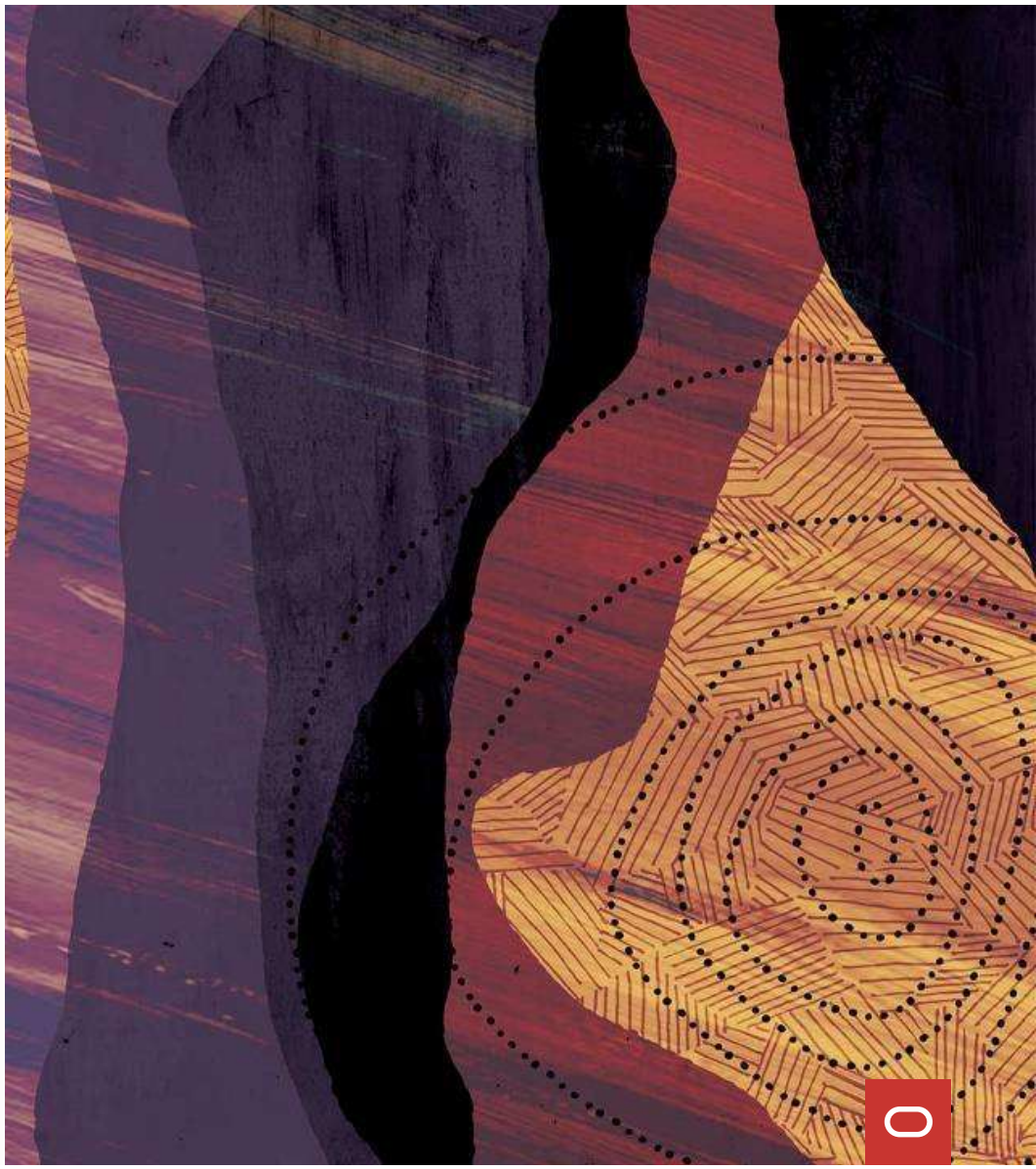
https://www.oracle.com/a/ocom/docs/dc/us44350118.pdf

# Q & A

sinan.petrus.toma@oracle.com

# Thank you

**Sinan Petrus Toma**

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