

ORACLE

Authenticating Oracle Db with OCI IAM token

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Create Enterprise Application within OCI IAM token

OCI Configuration steps

- Register the user in OCI IAM Domain (IDCS is not supported)

For Non Autonomous Database

- Enable TLS for Oracle Net
- Configure database for OCI_IAM AuthN

For Autonomous Database

- Configure database for OCI_IAM AuthN
- Configure sqlnet.ora

Configure Authorization server

- OCI IAM instance principal or OCI CLI profile
- Install OCI CLI

Configure client

- TLS enables
- Define token store
- Configure sqlnet.ora

Prerequisites

Oracle DBCS or Oracle Autonomous is a requirement.

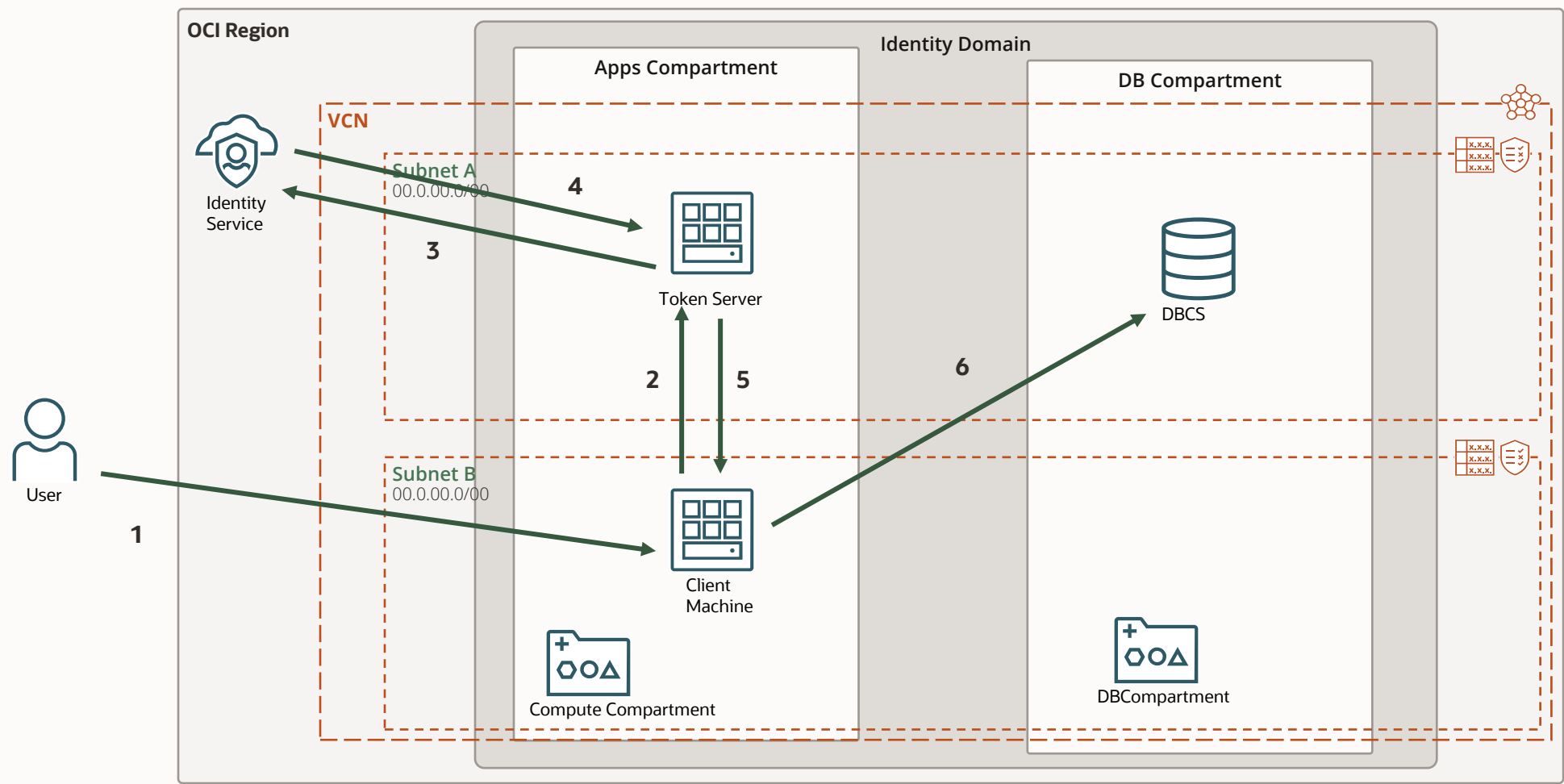
Minimum database version is 19.17

Token based authentication require TLS communication between the client application and the database

TLS may be configured with TLS Self service certificates

Authentication flow

Authentication flow



Authentication flow

1. User connect to client app
2. Client App request token from token server
3. Token server gets token from OCI IAM, (Instance principal)
4. Token server receives token
5. Client app receives token from token server
6. Application connects to the database over TLS

Configuration flow

1. Define user and groups at OCI IAM Level
2. Install OCI SDK on token server
3. Create user and groups in the target database, authenticated globally
4. Register the user in OCI IAM Domain, Create API Key
5. Configure the database to accept token based AuthN
6. Configure tnsnames.ora and sqlnet.ora on client

Initial prepare

Initial prepare

Define username in OCI

Define global username in the Oracle Database, mapped to the OCI_IAM username

Define group(s) name in OCI, assign the user to the group(s)

Define global group name in the Oracle Database, mapped to the OCI_IAM groups

The descriptions here in, assumes TLS communication between Client app and database is configured

Install OCI SDK on tokenserver

Install OCI SDK on token server

```
[opc@tokenclient ~]$ sudo yum install python36-oci-cli
Loaded plugins: langpacks, ulninfo
Resolving Dependencies
--> Running transaction check
---> Package python36-oci-cli.noarch 0:3.22.5-1.el7 will be installed
--> Processing Dependency: python36-jmespath = 0.10.0 for package: python36-oci-cli-3.22.5-1.el7.noarch
--> Processing Dependency: python36-oci-sdk = 2.91.0 for package: python36-oci-cli-3.22.5-1.el7.noarch
--> Processing Dependency: python36-prompt-toolkit = 3.0.29 for package: python36-oci-cli-3.22.5-1.el7.noarch
--> Processing Dependency: python36-terminaltables = 3.1.0 for package: python36-oci-cli-3.22.5-1.el7.noarch
--> Processing Dependency: python36-pyyaml < 6 for package: python36-oci-cli-3.22.5-1.el7.noarch
--> Processing Dependency: python36-arrow >= 1.0.0 for package: python36-oci-cli-3.22.5-1.el7.noarch
--> Processing Dependency: python36-pyyaml >= 5.4 for package: python36-oci-cli-3.22.5-1.el7.noarch
--> Running transaction check
---> Package python3-jmespath.noarch 0:0.10.0-1.el7 will be installed
---> Package python3-prompt-toolkit.noarch 0:3.0.29-1.0.2.el7 will be installed
--> Processing Dependency: python3-wcwidth for package: python3-prompt-toolkit-3.0.29-1.0.2.el7.noarch
---> Package python36-arrow.noarch 0:1.1.1-1.el7 will be installed
--> Processing Dependency: python36-dateutil >= 2.7.0 for package: python36-arrow-1.1.1-1.el7.noarch
--> Processing Dependency: python36-typing-extensions for package: python36-arrow-1.1.1-1.el7.noarch
---> Package python36-oci-sdk.x86_64 0:2.90.4-1.el7 will be updated
---> Package python36-oci-sdk.x86_64 0:2.91.0-1.el7 will be an update
---> Package python36-pyyaml.x86_64 0:5.4.1-1.0.1.el7 will be installed
---> Package python36-terminaltables.noarch 0:3.1.0-1.0.1.el7 will be installed
--> Running transaction check
---> Package python36-dateutil.noarch 1:2.7.5-1.0.1.el7 will be installed
---> Package python36-typing-extensions.noarch 0:3.7.4.2-1.el7 will be installed
---> Package python36-wcwidth.noarch 0:0.2.5-1.el7 will be installed
--> Finished Dependency Resolution
```

Create user and groups in the target database

Create users and groups in the PDB

User creation is at PDB level vs. Authentication configuration is at CDB level

```
SQL> create user ociuser identified globally as 'IAM_PRINCIPAL_NAME=pelle.parafin';
```

User created.

```
SQL> grant connect, resource to ociuser;
```

Grant succeeded.

```
SQL> alter user ociuser default tablespace users temporary tablespace temp;
```

```
SQL> CREATE ROLE oci_dba IDENTIFIED GLOBALLY AS  
'IAM_GROUP_NAME=dbusers';
```

Role created.

```
SQL> grant dba to oci_dba;
```

Grant succeeded.

Register the user in OCI IAM Domain

Create API Key

Create user pelle.parafin and assign to dbuser group

Domains | Oracle Cloud Infrastru

cloud.oracle.com/identity/domains/ocid1.domain.oc1..aaaaaaaazuls2b3hsbg6q44zg3ov5teewnpzslrfoo3yeloayollm2r72ua/users?tenant=iosociam&domain=Def...

Incognito

This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the [Console](#) to update the information or contact [Oracle Support](#).

ORACLE Cloud

Search resources, services, documentation, and Marketplace

Germany Central (Frankfurt)

Identity > Domains > Default domain > Users

Identity domain

Overview

Users

Groups

Dynamic groups

Applications

Oracle Cloud Services

Jobs

Reports

Security

Settings

Tag filters

add | clear

no tag filters applied

Users in Default Domain

Search by user name, first name, last name, or email

Create user | More actions

☐ Username

☐ [felix.starckjohann@oracle.com](#)

☐ [lisa.jones](#)

☐ [biom.inge.os@gmail.com](#)

☐ [casey.brown](#)

☐ [chris.craft](#)

☐ [dart.vader](#)

☐ [anne.duran](#)

☐ [inge.os@oracle.com](#)

0 Selected

Create user

First name Optional

Pelle

Last name

parafin

Username

pelle.parafin

Email

pelle.parafin@gmail.com

☐ Use the email address as the username

☐ Assign cloud account administrator role

Gives the user the highest level of access, which allows them to create new users, assign services roles, and more.

Groups Optional

Select groups to assign this user to.

Search...

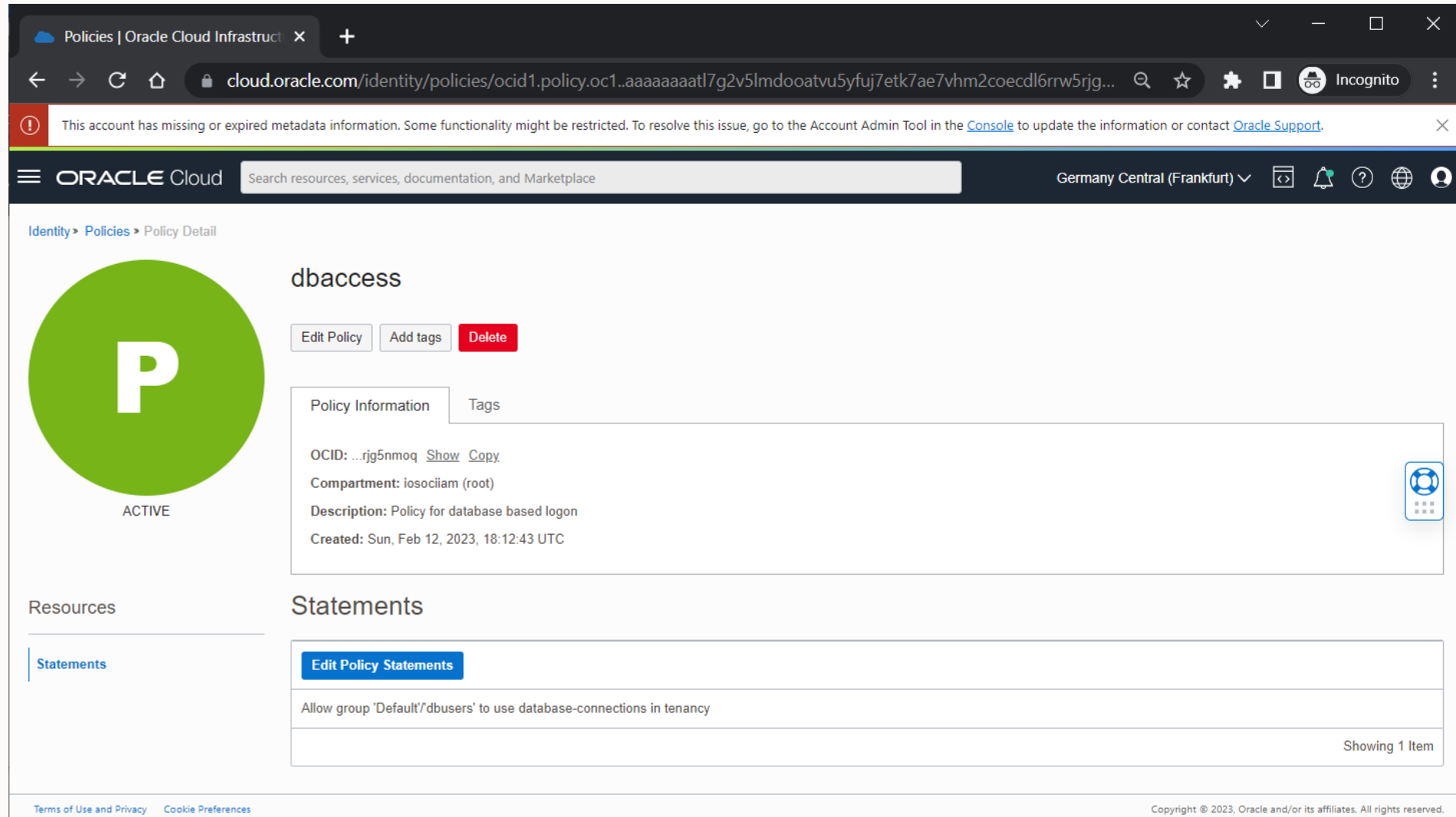
<input type="checkbox"/>	Name	Description
<input checked="" type="checkbox"/>	dbusers	Member of this group can create dbtokens
<input type="checkbox"/>	acme-security-admin-group	Landing Zone group for managing security services in compartment acme-security-cmp.
<input type="checkbox"/>	acmeiam	acmeiam

Create | Cancel

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Add policy for the correct OCI IAM Domain



The screenshot shows the Oracle Cloud Identity Policies page for a policy named 'dbaccess'. The page is viewed in an Incognito browser window. At the top, a warning message states: 'This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the [Console](#) to update the information or contact [Oracle Support](#).' The Oracle Cloud header includes a search bar and the region 'Germany Central (Frankfurt)'. The breadcrumb trail is 'Identity > Policies > Policy Detail'. The policy 'dbaccess' is represented by a green circle with a white 'P' and is marked as 'ACTIVE'. Action buttons for 'Edit Policy', 'Add tags', and 'Delete' are visible. The 'Policy Information' tab is selected, showing the OCID, Compartment (iosociam (root)), Description (Policy for database based logon), and Created date (Sun, Feb 12, 2023, 18:12:43 UTC). A 'Resources' sidebar on the left has a 'Statements' section. The 'Statements' tab shows one statement: 'Allow group 'Default'/dbusers' to use database-connections in tenancy'. An 'Edit Policy Statements' button is at the top of the statements list. The footer contains 'Terms of Use and Privacy', 'Cookie Preferences', and a copyright notice for 2023.

Policies | Oracle Cloud Infrastruct x +

cloud.oracle.com/identity/policies/ocid1.policy.oc1..aaaaaaaatl7g2v5lmdooatvu5yfuj7etk7ae7vhm2coecd16rrw5rjg... Incognito

This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the [Console](#) to update the information or contact [Oracle Support](#).

ORACLE Cloud Search resources, services, documentation, and Marketplace Germany Central (Frankfurt) ⌵

Identity > Policies > Policy Detail

dbaccess

ACTIVE

Edit Policy Add tags Delete

Policy Information Tags

OCID: ...rjg5nmoq [Show](#) [Copy](#)

Compartment: iosociam (root)

Description: Policy for database based logon

Created: Sun, Feb 12, 2023, 18:12:43 UTC

Resources

Statements

Edit Policy Statements

Allow group 'Default'/dbusers' to use database-connections in tenancy

Showing 1 Item

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Create API Key for the user

The screenshot shows the Oracle Cloud Identity Domains console. The browser address bar indicates the URL is `cloud.oracle.com/identity/domains/ocid1.domain.oc1..aaaaaaaazuls2b3hsbg6q44zg3ov5teewnpzslrfoo3yeloayoll...`. A warning banner at the top states: "This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the [Console](#) to update the information or contact [Oracle Support](#)." The main header shows "ORACLE Cloud" and a search bar. The breadcrumb trail is "Identity > Domains > Default domain > Users > pelle.parafin". The user profile for "Pelle parafin" is displayed, featuring a green circular avatar with a white 'U' and the status "ACTIVE". Action buttons include "Edit user", "Reset password", "Reset factors", "Edit user capabilities", and "More actions". The "User information" tab is active, showing details such as OCID, User name, Prefix, First name, Middle name, Last name, Suffix, Email, Recovery email, Instant messaging address, Home phone number, Mobile phone number, Federated status, My Oracle Support Account, and Authenticated by. Expandable sections for "Work information" and "Other information" are also visible.

Domains | Oracle Cloud Infrastru x +

cloud.oracle.com/identity/domains/ocid1.domain.oc1..aaaaaaaazuls2b3hsbg6q44zg3ov5teewnpzslrfoo3yeloayoll... Incognito

This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the [Console](#) to update the information or contact [Oracle Support](#).

ORACLE Cloud Search resources, services, documentation, and Marketplace Germany Central (Frankfurt)

Identity > Domains > Default domain > Users > pelle.parafin

Pelle parafin

ACTIVE

Edit user Reset password Reset factors Edit user capabilities More actions

User information Tags Capabilities

OCID: ...gni5kq [Show](#) [Copy](#)
User name: pelle.parafin
Prefix: -
First name: Pelle
Middle name: -
Last name: parafin
Suffix: -

Email: pelle.parafin@gmail.com
Recovery email: pelle.parafin@gmail.com
Instant messaging address: -
Home phone number: -
Mobile phone number: -
Federated: No
My Oracle Support Account: -
Authenticated by: IDCSApp

> Work information
> Other information

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Create API Key for the user

Domains | Oracle Cloud Infrastru

cloud.oracle.com/identity/domains/ocid1.domain.oc1..aaaaaaaazuls2b3hsbg6q44zg3ov5teewnpzslrlfoo3yeloayoll...

Incognito

This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the [Console](#) to update the information or contact [Oracle Support](#).

ORACLE Cloud

Search resources, services, documentation, and Marketplace

Germany Central (Frankfurt)

Resources

Groups

Applications

API keys

Auth tokens

OAuth 2.0 client credentials

SMTP credentials

Customer secret keys

Database passwords

Last name: parafin

Suffix: -

Federated: No

My Oracle Support Account: -

Authenticated by: IDCSApp

> Work information

> Other information

Groups

Assign user to groups

Remove user from group

<input type="checkbox"/>	Name	Description
<input type="checkbox"/>	dbusers	Member of this group can create dbtokens

0 Selected

Showing 1 Item < Page 1 >

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Create API Key for the user

Domains | Oracle Cloud Infrastru x +

cloud.oracle.com/identity/domains/ocid1.domain.oc1..aaaaaaaazuls2b3hsbg6q44zg3ov5teewnpzslrlfoo3yeloayoll... Incognito

This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the [Console](#) to update the information or contact [Oracle Support](#).

ORACLE Cloud Search resources, services, documentation, and Marketplace Germany Central (Frankfurt)

Last name: parafin
Suffix: -

> Work information
> Other information

Resources

- Groups
- Applications
- API keys
- Auth tokens
- OAuth 2.0 client credentials
- SMTP credentials
- Customer secret keys
- Database passwords

API keys

Add API key Delete

☐ Fingerprint

0 Selected

Add API key [Help](#)

Note: An API key is an RSA key pair in PEM format used for signing API requests. You can generate the key pair here and download the private key. If you already have a key pair, you can choose to upload or paste your public key file instead. [Learn more](#)

☒ Generate API key pair ☐ Choose public key file ☐ Paste a public key

Public key

i Download the private key. It will not be shown again. After you download it, [change the file permissions](#) so only you can view it

[Download private key](#) [Download public key](#)

[Add](#) [Cancel](#)

[Terms of Use and Privacy](#) [Cookie Preferences](#)

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Create API Key for the user

The screenshot shows the Oracle Cloud Identity Domains console in a web browser. The page title is "Add API key". A notification banner at the top states: "This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the Console to update the information or contact Oracle Support." The left sidebar shows the "API keys" section selected under "Resources". The main content area has three radio buttons: "Generate API key pair" (selected), "Choose public key file", and "Paste a public key". Below these, a "Public key" section contains an information icon and a message: "Download the private key. It will not be shown again. After you download it, change the file permissions so only you can view it". There are two buttons: "Download private key" (with a checkmark) and "Download public key" (with a download icon). At the bottom of the main area are "Add" and "Cancel" buttons. The footer shows "Terms of Use and Privacy", "Cookie Preferences", and "Copyright © 2023, Oracle and/or its affiliates. All rights reserved." A file manager bar at the very bottom shows a file named "pelle.parafin_202....pem" and a "Show all" button.

Domains | Oracle Cloud Infrastructure

cloud.oracle.com/identity/domains/ocid1.domain.oc1..aaaaaaaazuls2b3hsbg6q44zg3ov5teewnpzslrlfoo3yeloayoll...

This account has missing or expired metadata information. Some functionality might be restricted. To resolve this issue, go to the Account Admin Tool in the Console to update the information or contact Oracle Support.

ORACLE Cloud Search resources, services, documentation, and Marketplace Germany Central (Frankfurt)

Last name: parafin Suffix: -

> Work information

> Other information

Resources

- Groups
- Applications
- API keys
- Auth tokens
- OAuth 2.0 client credentials
- SMTP credentials
- Customer secret keys

API keys

Add API key Delete

☐ Fingerprint

0 Selected

Add API key

[Help](#)

Note: An API key is an RSA key pair in PEM format used for signing API requests. You can generate the key pair here and download the private key. If you already have a key pair, you can choose to upload or paste your public key file instead. [Learn more](#)

☒ Generate API key pair ☐ Choose public key file ☐ Paste a public key

Public key

i Download the private key. It will not be shown again. After you download it, [change the file permissions](#) so only you can view it

✓ Download private key Download public key

Add Cancel

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pelle.parafin_202....pem Show all

Create API Key for the user

cloud.oracle.com/identity/domains/ocid1.domain.oc1..aaaaaaaazuls2b3hsbg6q44zg3ov5teewnpzslrffoo3yeloayoll...

ORACLE Cloud

Germany Central (EU)

Configuration file preview

Note: This configuration file snippet includes the basic authentication information you'll need to use the SDK, CLI, or other OCI developer tool. Paste the contents of the text box into your ~/.oci/config file and update the key_file parameter with the file path to your private key. [Learn more](#)

Select API key fingerprint

6b0b9f3e25245b76fa8e127106ba45a8

Configuration file preview Read-only

```
[DEFAULT]
user=ocid1.user.oc1..
fingerprint=6b0b9f3e25245b76fa8e127106ba45a8
tenancy=ocid1.tenancy.oc1..legu36ca
region=eu-frankfurt-1
key_file=<path to your private keyfile> # TODO
```

Copy

Paste the contents of the text box into your ~/.oci/config file.

Showing 1 API key < Page 1 >

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pelle.parafin_202....pem

Show all

Copy these values for later token server OCI SDK config

Review of private key

Parts of the key is replaced with ...

```
-----BEGIN PRIVATE KEY-----
MIIEvQIBADANBgkqhkiG9w0BAQEFAASCBAKcwggSjAgEAAoIBAQDH5yaM8I82OaIR
WCKVo62HG5H6KONvWST8+6BCW6Y18W3DKlwihB15IcjUaHHBVXfrTp7UjKuYxCyX
xlwUQUoQTYR3lO/uNHISmrfYcnzTNQJhSMvwygxrXwVeJYzRdnPDv0e77IA+PBvT
ZfR7Nh6tobnJza7a2x/uEUiYEJX4IAISRuEQI2VEzhnA7YisGdYjCCM/Ocpb4z8l
Xkt7J09BZx4W3Lox3XW2dPFve78+5yTMwupW3l8pAEqTQhZwjTnpikUgLOOFLZOu
...
...
...
...
...
...
ObrWZJkfjFtvaAqLmMoUFB90hEVetr+vPj0+XzbYdkQqlRUCbSys2vJfm7XnzqON
GWpAnlTDzjQHM4nw0zZa6n8PXl333PPHzrqrucCgYEA3wo7RFvqxGNGVo6flQof
rgDi8v5UyZyh8yFFD+vHFSpJyYklset70bISQPs8pwIVGyVWwBKF3NcOoDldAPML
WjdmmaQjjgutYyFK0yy3+0ugWfV6Srh2JowKO7ugVdPIzACSkwF8mL7+jGvoetNC
MZlteToVPYL128YoOA3Qqbo=
-----END PRIVATE KEY-----
```


Configure the database to accept token based AuthN

1. Enable OCI IAM authentication and authorization
2. Verify the value of IDENTITY_PROVIDER_TYPE
3. Check if the IDENTITY_PROVIDER_CONFIG parameter, if so unset

```
ALTER SYSTEM SET IDENTITY_PROVIDER_TYPE=OCI_IAM SCOPE=BOTH;  
SELECT NAME, VALUE FROM V$PARAMETER WHERE NAME='identity_provider_type';  
SELECT NAME, VALUE FROM V$PARAMETER WHERE NAME='identity_provider_config';  
ALTER SYSTEM RESET IDENTITY_PROVIDER_CONFIG SCOPE=BOTH;
```


Example

SQL*Plus: Release 19.0.0.0.0 - Production on Mon Feb 13 21:51:34 2023
Version 19.17.0.0.0
Copyright (c) 1982, 2022, Oracle. All rights reserved.

SQL> ALTER SYSTEM SET IDENTITY_PROVIDER_TYPE=OCI_IAM SCOPE=BOTH;
System altered.

SQL> ALTER SYSTEM RESET IDENTITY_PROVIDER_CONFIG SCOPE=BOTH;
System altered.

SQL> SELECT NAME, VALUE FROM V\$PARAMETER WHERE NAME='identity_provider_type';

NAME	VALUE
-----	-----
identity_provider_type	OCI_IAM

SQL> SELECT NAME, VALUE FROM V\$PARAMETER WHERE NAME='identity_provider_config';

NAME	VALUE
-----	-----
identity_provider_config	



Configure tnsnames.ora and sqlnet.ora on client

Sample TNS entry for the connection

```
tokendemo=
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCPS) (HOST = ios.sub230462.iosvcn.oraclevcn.com) (PORT
= 2484))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = iosdb_pdb1.sub230462.iosvcn.oraclevcn.com)
    )
    (security=
      (ssl_server_cert_dn="CN=ios.sub0230462.iosvcn.oraclevcn.com")
    )
  )
```

Ssl_server_Cert must
match the database host
FQN

Sample sqlnet.ora entry for the connection

```
SQLNET.ENCRYPTION_SERVER=REQUIRED
SQLNET.CRYPTO_CHECKSUM_SERVER=REQUIRED
SQLNET.ENCRYPTION_TYPES_SERVER=(AES256,AES192,AES128)
SQLNET.CRYPTO_CHECKSUM_TYPES_SERVER=(SHA1)
SQLNET.ENCRYPTION_CLIENT=REQUIRED
SQLNET.CRYPTO_CHECKSUM_CLIENT=REQUIRED
SQLNET.ENCRYPTION_TYPES_CLIENT=(AES256,AES192,AES128)
SQLNET.CRYPTO_CHECKSUM_TYPES_CLIENT=(SHA1)
SQLNET.EXPIRE_TIME=10
WALLET_LOCATION =(SOURCE =(METHOD = FILE) (METHOD_DNAME =
(DIRECTORY = /u01/app/oracle/product/19.0.0/dbhome_1/wallet)))

SQLNET.AUTHENTICATION_SERVICES = (TCPS,NTS,BEQ)
SSL_CLIENT_AUTHENTICATION = FALSE
SSL_CIPHER_SUITES = (SSL_RSA_WITH_AES_256_CBC_SHA, SSL_RSA_WITH_3DES_EDE_CBC_SHA)
SSL_SERVER_DN_MATCH=TRUE
TOKEN_AUTH=OCI_TOKEN
TOKEN_LOCATION="/home/oracle/tokendemo/token"
```

SSL Wallet

Mandatory for
Token based
AuthN

File store for
AuthN token

Logon Example

Configure token server for API retrieval

Update \$HOME/.oci/config with entry for OCI user

1. Access the .oci folder under \$HOME
2. Edit the config file and create the profile entry with values from
3. “Create API Key for the user”
4. Copy the private key generated from “Create API Key for the user” to the file referenced in the config entry
5. Set the permissions on the private key to 0400

```
[oracle@ios .oci]$ pwd
/home/oracle/.oci
[oracle@ios .oci]$ ls
config  pelle.pem
[oracle@ios .oci]$ cat config
[pelle]
user=ocidl.user.oc1..aaaaaaaaxxxxxxxxxx
fingerprint=c2:8d:32:b8:f1:d5:63:f4:32:aa:23:fb:f3:f3:8b:8b
tenancy=ocidl.tenancy.oc1..aaaaaaaaxxxxxxxxxx
region=eu-frankfurt-1
key_file=/home/oracle/.oci/pelle.pem

[oracle@ios .oci]$ chmod 0400 pelle.pem
```

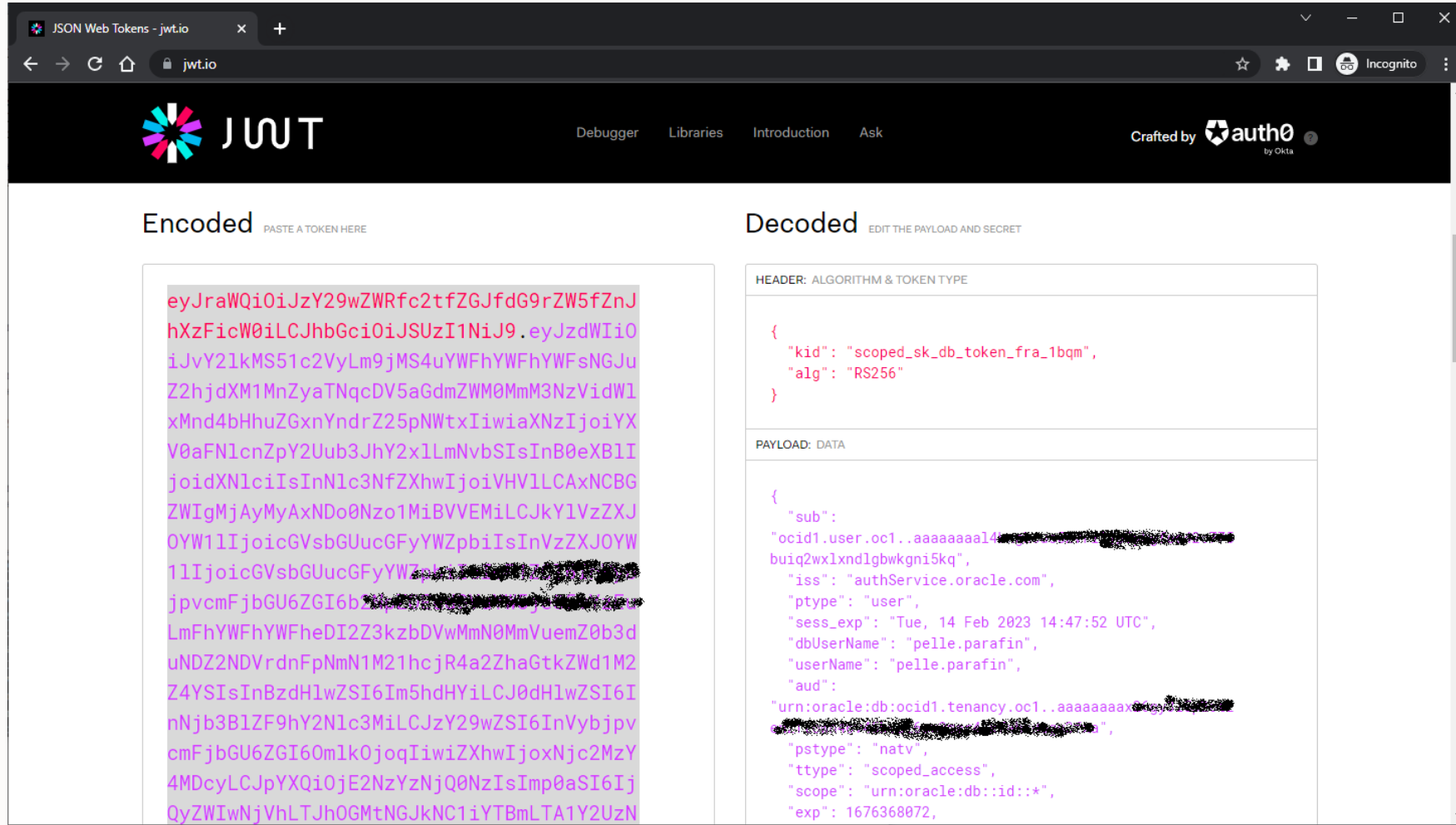
Token generation

SSH to the token server and generate a token

```
[oracle@ios .oci]$ oci iam db-token get --profile pelle  
Private key written at /home/oracle/.oci/db-token/oci_db_key.pem  
db-token written at: /home/oracle/.oci/db-token/token  
db-token is valid until 2023-02-14 09:47:52
```

Download the token and copy to token file referenced by sqlnet.ora

Token verification



Connect to the database

```
[oracle@ios tokendemo]$ export TNS_ADMIN=/home/oracle/tokendemo  
[oracle@ios tokendemo]$ sqlplus "/@tokendemo"
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Tue Feb 14 08:53:31 2023  
Version 19.17.0.0.0
```

```
Copyright (c) 1982, 2022, Oracle. All rights reserved.
```

```
Connected to:  
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 - Production  
Version 19.17.0.0.0
```

```
SQL>
```

References

Autonomous Token based AuthN configuration

<https://blogs.oracle.com/cloudsecurity/post/sqlplus-to-autonomous-database-using-oci-iam>

OCI SDK Install

https://docs.oracle.com/en-us/iaas/Content/API/SDKDocs/cliinstall.htm#InstallingCLI_oraclelinux7

SQLNET TLS/SSL configuration

<https://oracle-base.com/articles/misc/configure-tcpip-with-ssl-and-tls-for-database-connections>

DBCS token based authentication

<https://blogs.oracle.com/cloudsecurity/post/sqlplus-to-autonomous-database-using-oci-iam>

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