

Technical brief: Securely Accessing ExaCS or DBCS with Bastion Service

A example guide on how Bastion service can improve the security and governance of Linux VM access to Database Cloud Service or ExadataCloud Service

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Purpose

In the shared responsibility model of PaaS Services like Database Cloud Service, DBCS, or Exadata Cloud Services, ExaCS, the service consumers are granted OS access, and have some responsibilities requiring access to the Linux OS, as user *oracle* or with group membership equal to the *oracle* user.

The services is created with the *opc* account, authenticated with a private/public ssh keypair. User *opc* is configured to offer sudo *root* access.

To improve the security for DBCS and ExaCS, customers would like to limit operator access to *opc* and *root* accounts, and enforce an access model to the Linux VM, or nodes by:

- Prevent any logon to *opc* or *root* accounts
- Keep full central governance over which operator is granted access rights, through the centralized IAM Domain in Oracle OCI
- Generate centralized audit records of any logons to the Linux VM/nodes

From a governance perspective, organizations are required to enforce the usage of named users, and not common accounts Linux like *opc* or *oracle*, for the purpose of accountability and auditability

Central governance, with central user CRUD, is the preferred opting, avoiding fragmented user management

The purpose of this document is to give the reader inspiration to how such a model may be implemented with Oracle OCI Bastion services.

For ExaCC, a local bastion service or tools like CyberArk need to be applied.

Overview of the OCI Bastion Service

Oracle Cloud Infrastructure (OCI) Bastion service, is a fully managed service providing secure and ephemeral Secure Shell (SSH) access to the private resources in OCI. OCI Bastion service, like the bastion fortress of medieval times, improves security posture by providing an additional layer of defence against external threats.

The cost, deployment, and management of using a jump host is a huge pain point which can lead to a weaker security posture for the customer. The OCI Bastion service removes the public and private virtual cloud networking (VCN) hassle for access to a jump host. No public IP is needed, resulting in no surface attack area or zero-day vulnerabilities with a dedicated jump host. Customers also eliminate shared credentials, broad access limits, and other bad habits of using jump hosts. OCI Bastion service integrates with OCI Identity and Access Management (IAM) and allows the organization to control who can access a bastion or a session and what they can do with those resources.

The main security features of the OCI Bastion service are:

- Provides restricted and time-limited secure access to resources that don't have public endpoints and require strict resource access controls

- With Oracle Cloud Infrastructure (OCI) Bastion service, customers can enable access to private hosts without deploying and maintaining a jump host.
- Gaining improved security posture with identity-based permissions and a centralized, audited, and time-bound SSH session
- Oracle OCI Bastion service utilizes Oracle OCI IAM, removing the need for user governance on Linux host, centralizing all user governance, RBAC access to one single instance of Oracle OCI IAM

For more info, please refer to:

- Oracle OCI Bastion services

<https://docs.oracle.com/en-us/iaas/Content/Bastion/Concepts/bastionoverview.htm>

- Oracle OCI Identity Domains

<https://docs.oracle.com/en-us/iaas/Content/Identity/getstarted/identity-domains.htm>

Traditional Linux user governance

This section outlines traditional, Linux level, approaches to governance of VM and nodes.

The users Linux account is assigned to the required groups at Linux level to provide access to the oracle software owner and grid software owner.

DBCS and ExaCS runs on Oracle Enterprise Linux, OEL, supporting standard Linux user management/user governance

From a Linux perspective the following will partly support the common requirements:

Oracle Linux account is shared:

- Don't share the *opc* private key, no one is allowed to use ssh with the *opc* private key.
- Each user signing into the Linux node has their own private key. The *oracle* account is public and Shared *oracle* account
- Each user signing into the Linux node has their own private key, but signs into user *oracle*. The *oracle* account is public and is shared. The user's public keys are stored in `~/.ssh/authorized_keys`

Individual accounts

- For each user a personal account is created with the user's public key in the users authorized keys file, or the user is authenticated via LDAP over Linux PAM
- The users Linux account is assigned to the required groups at Linux level to provide access to the *oracle* software owner and grid software owner

The traditional Linux governance or Linux type of bastion/jump server has a few drawbacks like:

- No central user governance, users or keys needs to be maintained at VM or node level, at all VMs and nodes
- Central IAM may be deployed with agents and IAM integration, yet another IAM solution to be maintained
- No central audit for malicious user access detection

Lock down of OPC user.

Generally speaking the Linux user OPC should only be used under rare conditions and be managed as a break glass users.

A simple approach is:

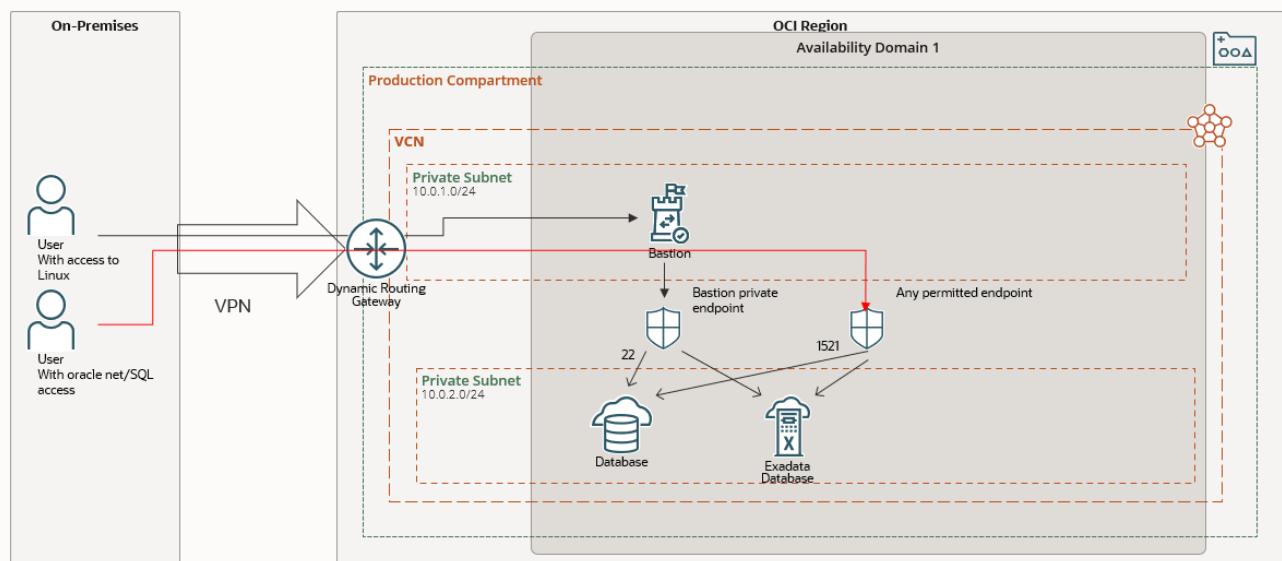
- Remove any public key, created by your organization from the .ssh/authorized_keys
- Let a security admin generate a new SSH private/public key pair.
- Add the new public key to .ssh/authorized_keys
- When required, the private key is requested from security officer.
- The security officer generates a new private/public SSH key pair, and the public key in .ssh/authorized_keys is replaced.
- The process is manual and needs to be monitored with two set of eyes.

More robust processes will be like ie, add Linux PAM integrated with Oracle OCI IAM.

Use Oracle OCI Bastion Service

With the usage of the Bastion service, an ephemeral ssh tunnel is created for a limited period of time. The only permitted traffic to the VM or compute node is routed through the Bastion service.

At network level, the Network Security Group, NSG, for the VM or compute node is configured, only to allow traffic over port 22 from the endpoint of the Bastion service.



Simplified network example network configuration

Security Rules

These security rules apply to all VNICs in this network security group. You can filter the list by ingress or egress. There can be other security rules that apply to a given VNIC in this group: from any other network security groups the VNIC is in, and any security lists associated with the VNIC's subnet. [Learn more about security rules](#).

	Direction <i>i</i>	Source or Destination <i>i</i>	Protocol <i>i</i>	Details <i>i</i>	Description <i>i</i>	
<input type="checkbox"/>	Direction: Egress <input type="checkbox"/> Stateless: No	Destination Type: CIDR Destination: 10.3.0.0/16	All Protocols	Allow: All tra... Show	Any outbound traffic to local sub net	:
<input type="checkbox"/>	Direction: Ingress <input type="checkbox"/> Stateless: No	Source Type: CIDR Source: 10.3.4.100/32	TCP	Source Port Range: All Destination Port Range: 22 Allow: TCP tra... Show	Only accept ssh access from ba stion service	:

Example of NSG rule protecting the DBCS node.

All access to DBCS or ExaCS Linux VM is tunneled through the Bastion service

The Bastion service resides in a compartment, and only OCI users with access, through OCI policies, to the compartment and the Bastion service will be able to create a bastion ssh session to the Linux VM.

The Bastion service is configured with a private/public ssh key pair, with the public key in the authorized_keys file of the *oracle* user. The *opc* account private key is not used and not shared.

The VCN network is configured so the only permissible access over port 22 is from the private endpoint of the bastion host. Oracle net/SQL traffic over port 1521/1522 is permitted from the private subnet

Bastion service support two types of ssh tunnel:

- Managed SSH Session, for compute nodes with the OCI agent running
- SSH Port forwarding session, for compute nodes, like DBCS and ExaCS, without running OCI agent.

For the protection of DBCS and ExaCS VMs/nodes the SSH Port Forwarding session type is required.

Bastion service configuration

Create the Bastion service, which created the private endpoint in the subnet

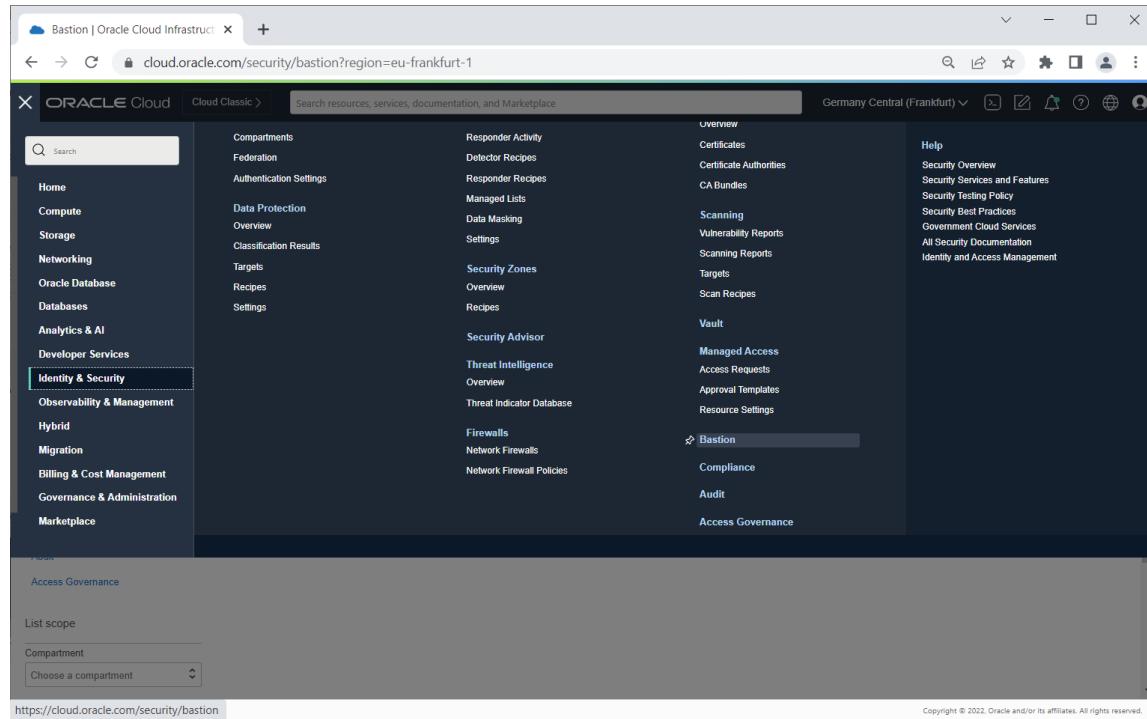
Create a private ssh key pair pr. user that needs access. Upload the public key to `~/.ssh/authorized_keys` in the `oracle` account on the DBCS or ExaCS server

For each time access is needed, create a Bastion session. The Bastion session is valid for 3 hours, The bastion session generates a new ssh private/public key pair, used for ssh connection to the Bastion service

The private key for authentication of the `oracle` Linux account is tunneled through the Bastion session

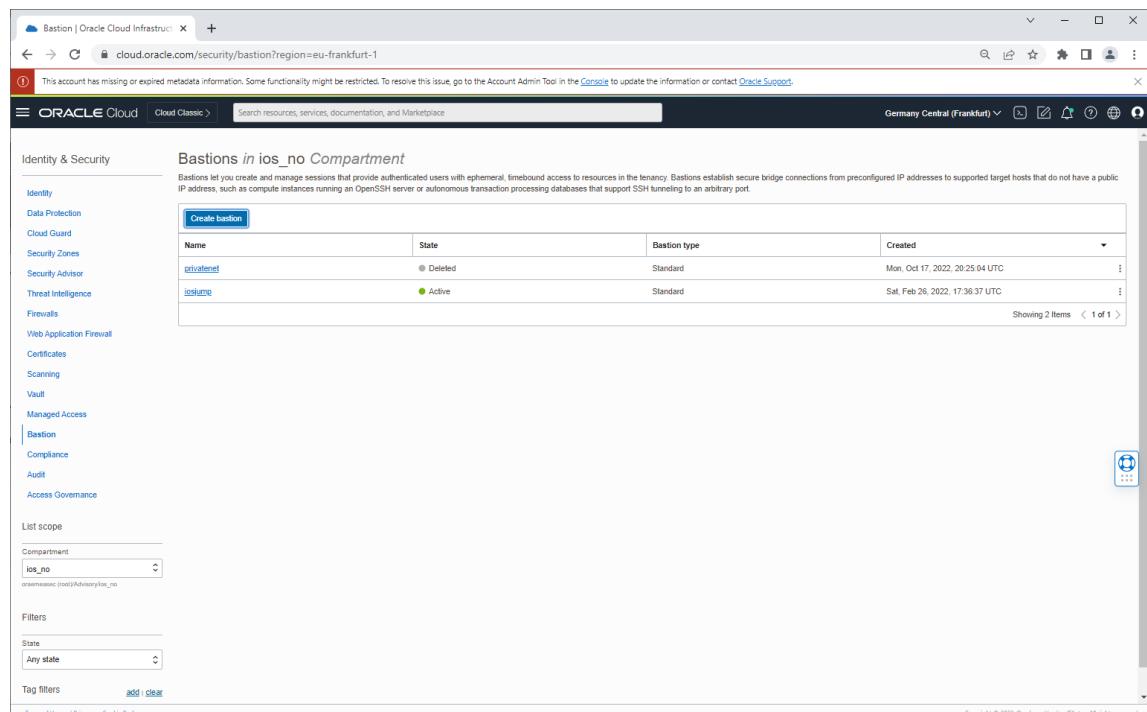
Bastion service creation

This section is a walk through of creation of the Bastion service, a prerequisite for creating any Bastion session



https://cloud.oracle.com/security/bastion

Navigate to the bastion item under Identity & Security



Select target compartment for the Bastion service.

Define which subnet the bastion will reside in. this defines the private endpoint, configured in the NSG later.

Configure allowable inbound CIDR range. Typically, the CIDR range of the VPN connection will be used.

Bastion | Oracle Cloud Infrastructure

cloud.oracle.com/security/bastion/bastions/ocid1.bastion.oc1.eu-frankfurt-1.amaaaaaaupfargiaagg2k5ndzgenayjaxqryrusuawkjqhgochvxbuphaa?region=eu-frankfurt-1

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

Security > Bastion > dbbastion

dbbastion

ACTIVE

B

OCI: buphas [Show](#) [Copy](#)

Created: Tue, Oct 25, 2022, 10:43:03 UTC

Target virtual Cloud network:

Target subnet:

Maximum session time-to-live (TTL): 3 hours, 00 minutes

CIDR block allowlist: 10.3.0.0/24

Compartment: oraemeesec (root)/Advisory/09_no

Private endpoint IP address: 10.3.4.100

Bastion type: Standard

Resources

Sessions

Create session

Name	Session type	Target resource	Target port	Username	State	Session TTL	Started
Loading							

Showing 0 Items < 1 of 1 >

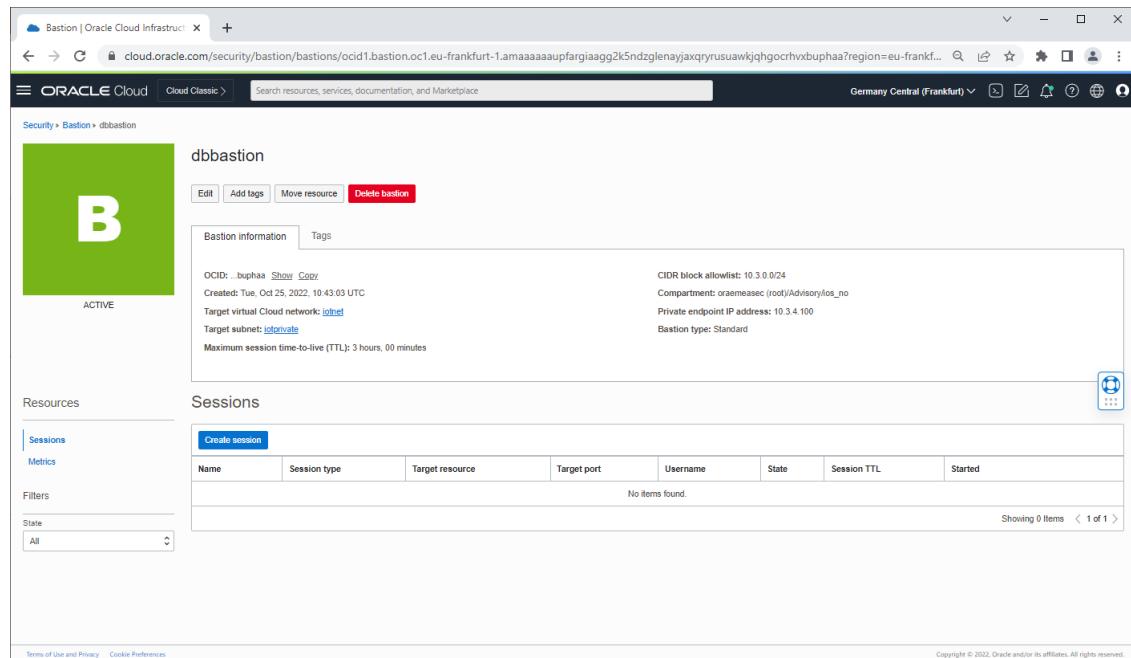
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The Bastion service is created, take a note2 of the private endpoint, for later NSG configuration

Bastion session creation

A bastion session is a time limited access granted to a user, that is audited and managed by OCI IAM policies.



dbbastion

B

ACTIVE

Bastion information

OCID: ... buphaa [Show](#) [Copy](#)
Created: Tue, Oct 25, 2022, 10:43:03 UTC
Target virtual Cloud network: [i0tnei](#)
Target subnet: [i0tnei](#)
Maximum session time-to-live (TTL): 3 hours, 00 minutes

CIDR block allowlist: 10.3.0.0/24
Compartment: orameasec (root)/Advisory/ios_no
Private endpoint IP address: 10.3.4.100
Bastion type: Standard

Resources

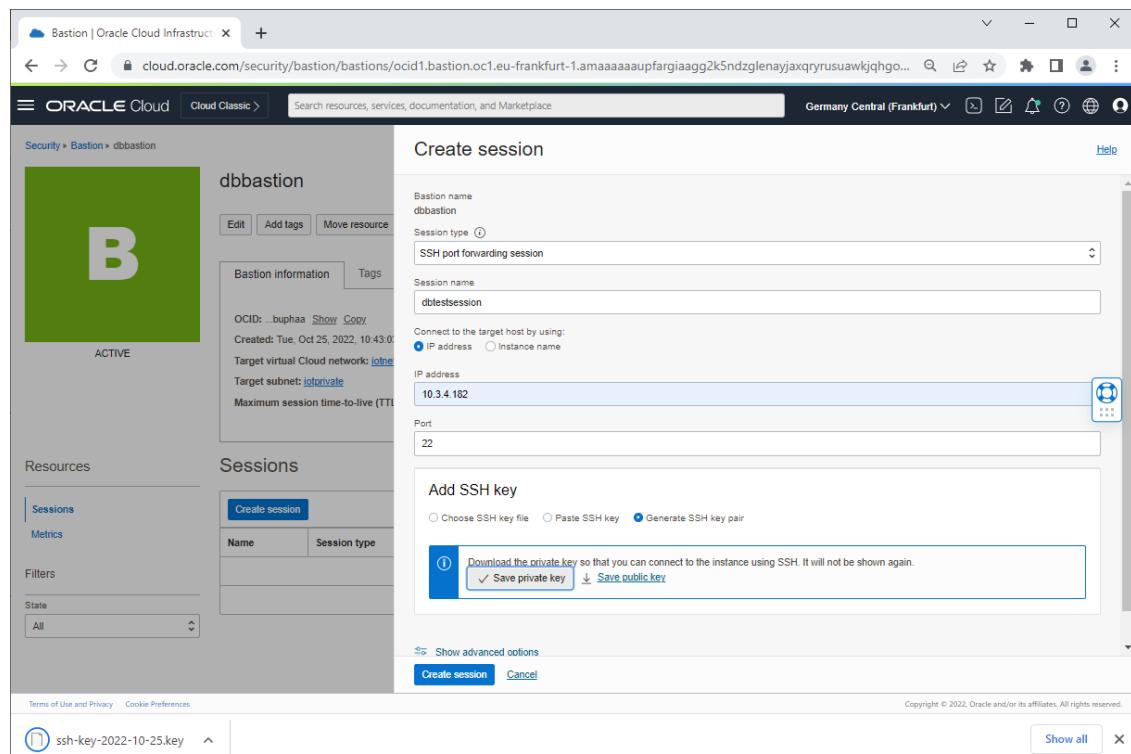
Sessions

Name	Session type	Target resource	Target port	Username	State	Session TTL	Started
dbbastion	SSH port forwarding session	dbbastion	22		Not Started	3 hours, 00 minutes	Not Started

No items found.

Showing 0 items < 1 of 1 >

Navigate to the applicable Bastion service



Create session

Bastion name: dbbastion

Session type: SSH port forwarding session

Session name: dbtestsession

Connect to the target host by using:

IP address Instance name

IP address: 10.3.4.182

Port: 22

Add SSH key

Choose SSH key file Paste SSH key Generate SSH key pair

Download the [private key](#) so that you can connect to the instance using SSH. It will not be shown again.

Save private key Save public key

Show advanced options

Create session Cancel

ssh-key-2022-10-25.key

Select SSH Port Forwarding, generate ssh key pair and save the private key. The private key is later uploaded to the ssh agent

The screenshot shows the Oracle Cloud Infrastructure (OCI) Bastion page for a resource named 'dbbastion'. The main interface includes a large green square with a white 'B' icon, resource details, and a session table.

Resource Details:

- OCID: dbbastion
- Created: Tue, Oct 25, 2022, 10:43:03 UTC
- Target virtual Cloud network: [inet](#)
- Target subnet: [private](#)
- CIDR block allowlist: 10.3.0.0/24
- Compartment: oraeamesec (root)/Advisory/los_no
- Private endpoint IP address: 10.3.4.100
- Bastion type: Standard
- Maximum session time-to-live (TTL): 3 hours, 00 minutes

Sessions:

Create session							
Name	Session type	Target resource	Target port	Username	State	Session TTL	Started
dbtestsession	Port forwarding	10.3.4.182	22	-	Active	3 hours, 00 minutes	Tue, Oct 25, 2022, 12:38:01 UTC

Showing 1 item < 1 of 1 >

The session is created with a default expire time of 180 min.

Traffic flow

The DBCS or ExaCS instances resided in a separate subnet, 10.0.2.0/24, and Network Security Groups, NSG, is configured for permitting ingress/egress traffic.

With a NSG, the only permitted traffic over port 22 to the DBCS instance or ExaCS instance s from the private endpoint of the Bastion service, resides in the 10.0.1.0/24 subnet

Oracle Net traffic is configured based on the application and oracle net/SQL traffic requirements, in the example, only from the 10.0.1.0/24 subnet

The typical NSG firewall configuration for the target VM/node will allow for traffic on port 22 only from the Bastion service private endpoint, as an example 10.2.4.100/32, and open for port 1521/1522 for applicable database traffic.

ssh access to target resource via ssh tunnel

- 1) Start the ssh-agent

```
eval `ssh-agent`
```

- 2) Upload the users own private key

```
ssh-add myprivatekey.key
```

- 3) Upload the private key created by the bastion session

```
ssh-add bastion-session.key
```

- 4) Create a resident ssh tunnel to the target, through the Bastion service

```
ssh -N -4 -L 8222:10.3.4.182:22 -p 22 ocid1.bastionsession.ocl.eu-frankfurt-1.a*****@host.bastion.eu-frankfurt-1.oci.oraclecloud.com
```

- 5) Connect to the target over the ssh tunnel

```
ssh oracle@localhost -p 8222
```

```
[ios@ios3 ~]$ ssh-add -l
The agent has no identities.
[ios@ios3 ~]$ ssh-add .ssh/iosstd
Identity added: .ssh/iosstd (.ssh/iosstd)
[ios@ios3 ~]$ ssh-add .ssh/ses.key
Identity added: .ssh/ses.key (.ssh/ses.key)
[ios@ios3 ~]$ ssh-add -l
2048 SHA256:zoFfJmFc0GzG2R/7j8tG/+8fswxLnUROIvTWB9LvtAY .ssh/iosstd (RSA)
2048 SHA256:qS+uTND8xnghyB2vFsuZ2ggc79juxOXfRTjB9nYtqI .ssh/ses.key (RSA)
[ios@ios3 ~]$ ssh -4 -N -L 8222:10.3.4.182:22 -p 22 ocid1.bastionsession.ocl.eu-frankfurt-1.amaaaaaaupfargiajmymczp2rbe6qxthyg24jg4klyanpmv177q457xhw33q@host.bastion.eu-frankfurt-1.oci.oraclecloud.com
```

Example of starting the ssh agent

```
[ios@ios3 cloud_scripts]$
[ios@ios3 cloud_scripts]$
[ios@ios3 cloud_scripts]$
[ios@ios3 cloud_scripts]$ ssh oracle@localhost -p 8222
Last login: Tue Oct 25 12:51:07 2022
[oracle@ios ~]$ uname -a
Linux ios 4.14.35-2047.510.5.5.el7uek.x86_64 #2 SMP Fri Jan 28 08:33:42 PST 2022 x86_64 x86_64 x86_64 GNU/Linux
[oracle@ios ~]$ exit
logout
Connection to localhost closed.
[ios@ios3 cloud_scripts]$
```

Example Session

Example script for creating Bastion service session

The applicable scripts are available on git:

<https://github.com/oracle-devrel/technology-engineering/tree/main/security/security-design/shared-assets/bastion-py-script>

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