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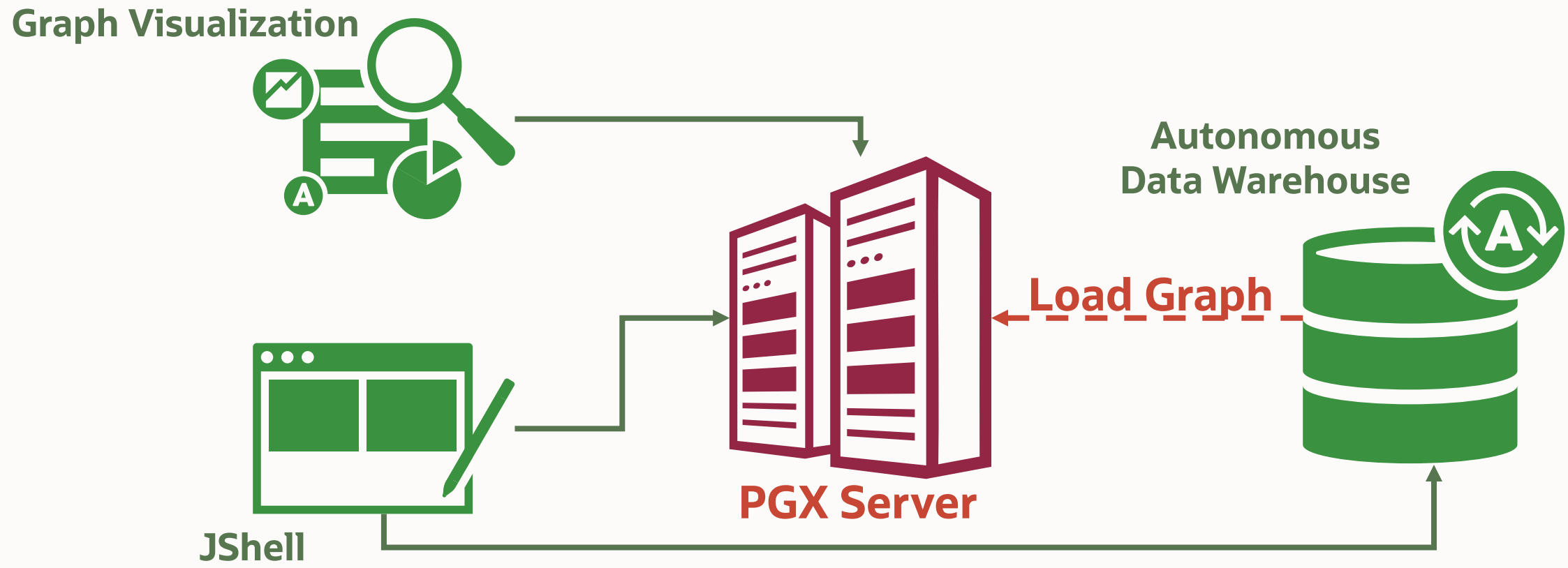
Graph Lab Architecture



Autonomous Data Warehouse Provision

Autonomous Data Warehouse Tutorial

Tutorial

- https://docs.oracle.com/en/cloud/paas/autonomous-data-warehouse-cloud/tutorials.html

Workshop 1: Autonomous Database Quickstart

- https://oracle.github.io/learning-library/data-management-library/autonomous-database/shared/adb-quickstart-workshop/freetier/

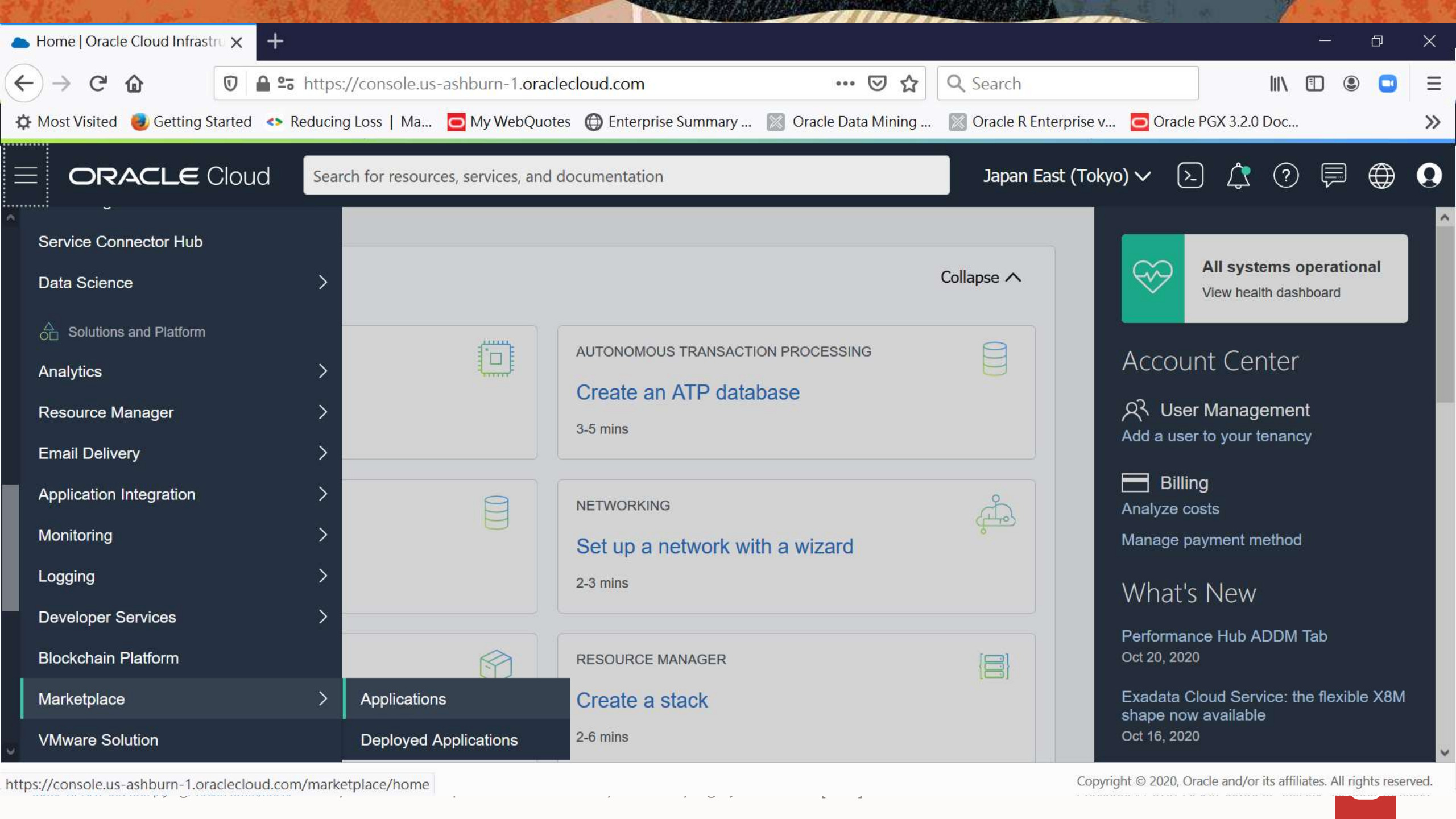
Connect Securely Using SQL Developer with a Connection Wallet

- https://oracle.github.io/learning-library/data-management-library/autonomous-database/shared/adb-advanced-workshop/freetier/?lab=lab-6-using-wallets-for-secure

Oracle Graph Server Provision

Generating an SSH Key Pair for Oracle Compute Cloud Service Instances

- https://www.oracle.com/webfolder/technetwork/tutorials/obe/cloud/compute-iaas/generating_ssh_key/generate_ssh_key.html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3-5 mins
NETWORKING
Set up a network with a wizard
2-3 mins
RESOURCE MANAGER
Create a stack
2-6 mins
All systems operational
View health dashboard
Account Center
User Management
Add a user to your tenancy
Billing
Analyze costs
Manage payment method
What's New
Performance Hub ADDM Tab
Oct 20, 2020
Exadata Cloud Service: the flexible X8M shape now available
Oct 16, 2020
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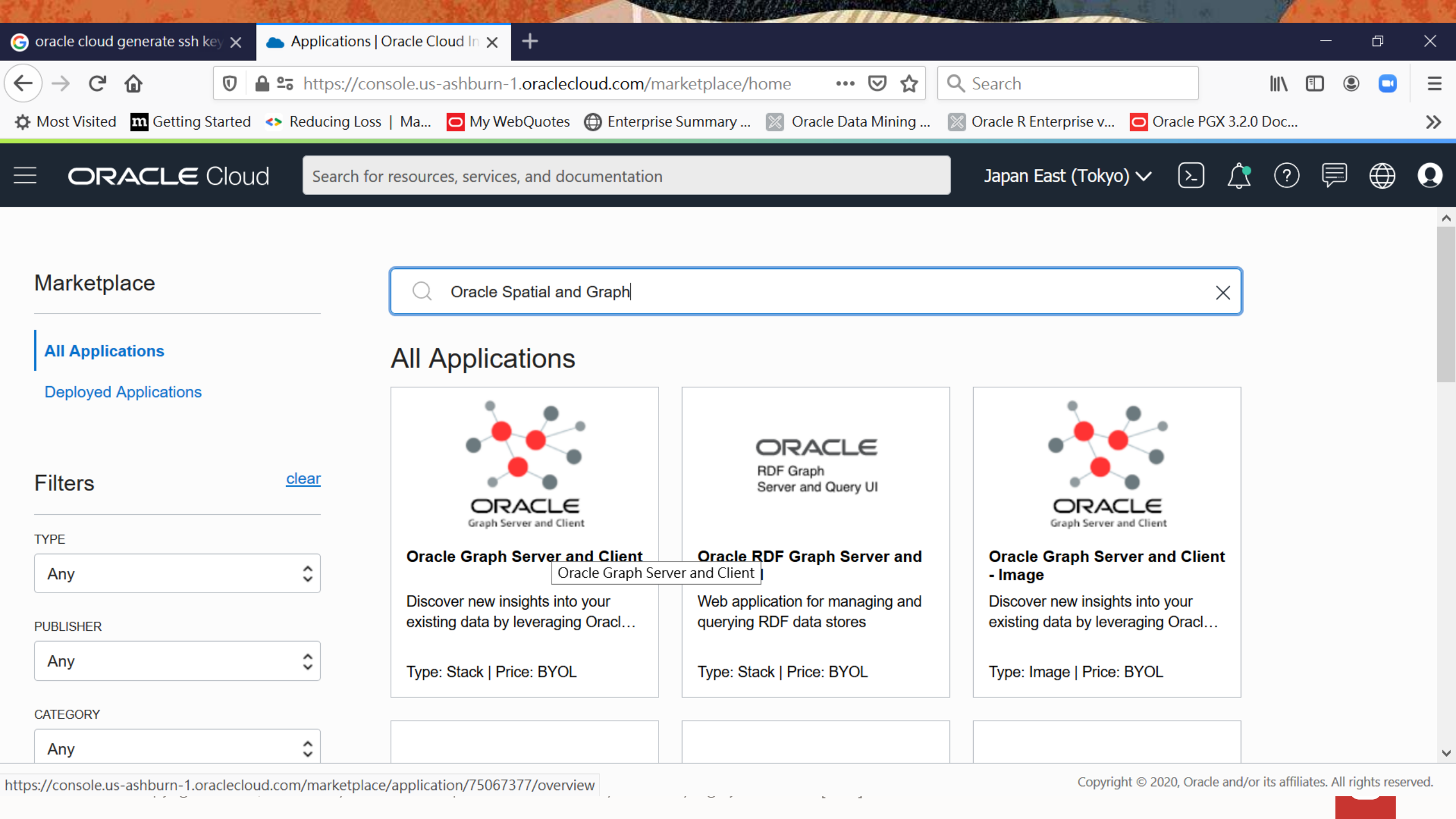
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CATEGORY
Any
Oracle Spatial and Graph
All Applications
ORACLE
Graph Server and Client
Oracle Graph Server and Client
Discover new insights into your existing data by leveraging Oracl…
Type: Stack | Price: BYOL
ORACLE
RDF Graph
Server and Query UI
Oracle RDF Graph Server and
Web application for managing and querying RDF data stores
Type: Stack | Price: BYOL
ORACLE
Graph Server and Client
Oracle Graph Server and Client - Image
Discover new insights into your existing data by leveraging Oracl…
Type: Image | Price: BYOL
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Marketplace » Oracle Graph Server and Client

Oracle Graph Server and Client

Discover new insights into your existing data by leveraging Oracle's powerful graph technologies

This stack provides a pre-installation of the Oracle Graph Server and Client using Oracle JDK on an Oracle Linux 7 base image.

Categories: Analytics, Packaged Application, Big Data

Type
Stack

Version
20.4.0 - default

Compartment
MichaelCompartment

hktwlab (root)/TWSELAB01/Michael Compartment

Software Price per OCPU

BYOL

(Bring Your Own License)

There are additional fees for the infrastructure usage.

I have reviewed and accept the Oracle Standard Terms and Restrictions.

Launch Stack

Overview | **Provider** | **More Apps** | **Usage Instructions**

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Create Stack

Help

1. **Stack Information**
2. Configure Variables
3. Review

Your application will launch as part of a stack that includes the infrastructure resources required to ensure that the application deploys and runs properly.

NAME *OPTIONAL*

Oracle Graph Server and Client

DESCRIPTION *OPTIONAL*

Next Cancel

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Create Stack

Help

1. Stack Information
2. **Configure Variables**
3. Review

Configure the variables for the infrastructure resources that this stack will create when you run the apply job for this execution plan.

Oracle Graph Server Compute Instance

RESOURCE NAME PREFIX

oraclegraph

The name of all created compute and network resources will begin with this prefix

ORACLE GRAPH SERVER COMPARTMENT

MichaelCompartment

The compartment in which to create the Oracle Graph Server compute instance

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Create Stack

Help

1. Stack Information
2. **Configure Variables**
3. Review

MichaelCompartment

The compartment in which to create the Oracle Graph Server compute instance

ORACLE GRAPH SERVER AVAILABILITY DOMAIN

Select an option

The name of the availability domain in which to create the Oracle Graph Server compute instances

ORACLE GRAPH SERVER SHAPE

Select an option

The shape for the Oracle Graph Server compute instance

SSH PUBLIC KEY

Use the corresponding public key to access the Oracle Graph Server compute instance

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Create Stack

Help

1. Stack Information
2. **Configure Variables**
3. Review

VM.Standard.B1.2
VM.Standard.B1.4
VM.Standard.B1.8
VM.Standard.E2.1
VM.Standard.E2.2
VM.Standard.E2.4
VM.Standard.E2.8
VM.Standard2.1
VM.Standard2.16
VM.Standard2.2
VM.Standard2.24
VM.Standard2.4
VM.Standard2.8

Select an option

The shape for the Oracle Graph Server compute instance

SSH PUBLIC KEY

Use the corresponding public key to access the Oracle Graph Server compute instance

Back | Next | Cancel

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Create Stack

Help

1. Stack Information
2. **Configure Variables**
3. Review

Select an option

The shape for the Oracle Graph Server compute instance

SSH PUBLIC KEY

ssh-rsa AAAAB3NzaC1yc2EAAAABJQAAAQEAI7WQ8i7ucZdnpFZKqluDVKgEqWa4SDlgwLiwtmifWHV1yM839d/trvMT

Use the corresponding public key to access the Oracle Graph Server compute instance

Instance Network

VIRTUAL CLOUD NETWORK COMPARTMENT

Choose...

EXISTING VIRTUAL CLOUD NETWORK

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Create Stack

Help

1. Stack Information
2. **Configure Variables**
3. Review

Instance Network

VIRTUAL CLOUD NETWORK COMPARTMENT

MichaelCompartment

hktwlab (root)/TWSELAB01/MichaelCompartment

EXISTING VIRTUAL CLOUD NETWORK

michaelvcn

An existing Virtual Cloud Network (VCN) in which to create the compute instance.

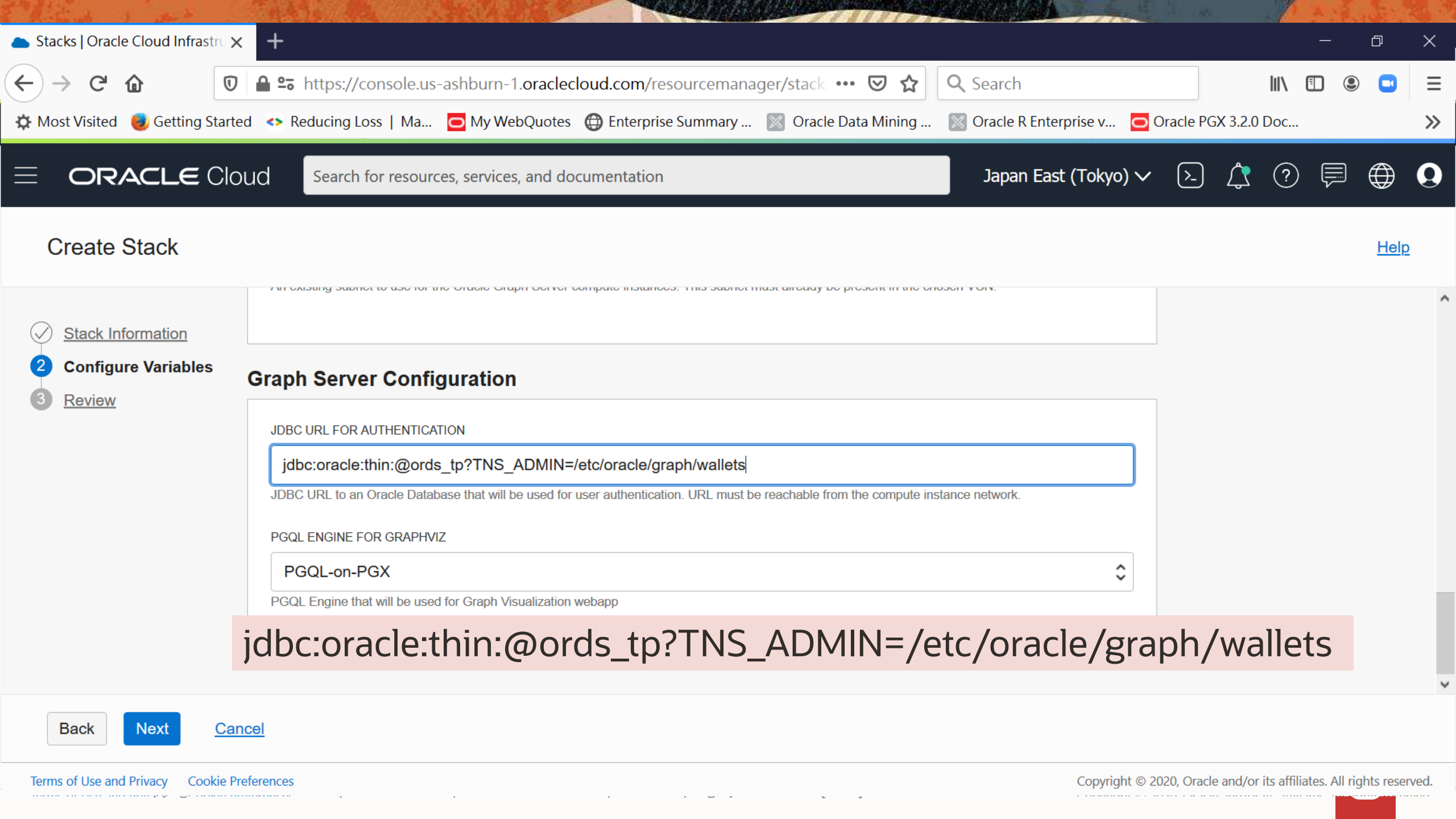
SUBNET COMPARTMENT

MichaelCompartment

hktwlab (root)/TWSELAB01/MichaelCompartment

EXISTING SUBNET

Back | Next | Cancel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Create Stack
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Stack Information
2 Configure Variables
3 Review
Graph Server Configuration
JDBC URL FOR AUTHENTICATION
jdbc:oracle:thin:@ords_tp?TNS_ADMIN=/etc/oracle/graph/wallets
JDBC URL to an Oracle Database that will be used for user authentication. URL must be reachable from the compute instance network.
PGQL ENGINE FOR GRAPHVIZ
PGQL-on-PGX
PGQL Engine that will be used for Graph Visualization webapp
jdbc:oracle:thin:@ords_tp?TNS_ADMIN=/etc/oracle/graph/wallets
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Create Stack

Help

1. Stack Information
2. Configure Variables
3. **Review**

Verify your configuration variables, and then create your stack. The apply job will automatically run to create resources specified in the configuration. Due to limited space, we show only variables without default values or that you edited.

Stack Information

Name	Oracle Graph Server and Client
Description	
Compartment	...pnvbka Show Copy
Terraform version	0.12.x

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Instances | Oracle Cloud Infra

https://console.us-ashburn-1.oraclecloud.com/compute/instances

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- Instances
- Dedicated Virtual Machine Hosts
- Instance Configurations
- Instance Pools
- Cluster Networks
- Autoscaling Configurations
- Custom Images
- Boot Volumes
- Boot Volume Backups
- OS Management

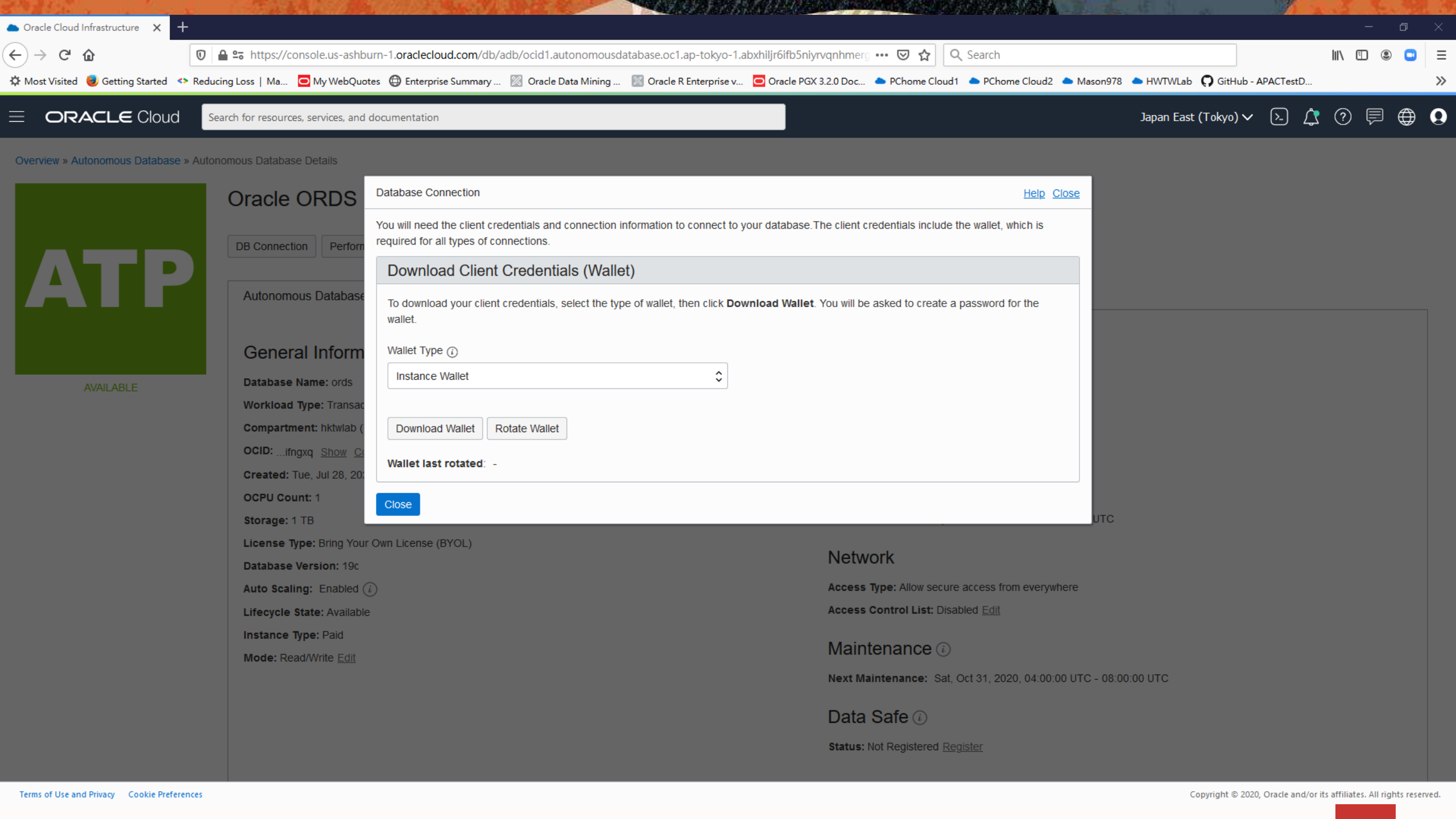
Instances *in* MichaelCompartment *Compartment*

The Compute service helps you provision VMs and bare metal instances to meet your compute and application requirements. An instance is a compute host. Choose between virtual machines (VMs) and bare metal instances. The image that you use to launch an instance determines its operating system and other software.

Create Instance

Name	State	Public IP	Shape	OCPU Count	Memory (GB)	Availability Domain	Fault Domain
pgx	Running	158.101.144.184	VM.Standard.E2.8	8	64	AD-1	FD-1
DBSecLab-v3	Running	140.238.52.66	VM.Standard.E3.Flex	6	96	AD-1	FD-2

Graph Server Configuration


Oracle Cloud Infrastructure
https://console.us-ashburn-1.oraclecloud.com/db/adb/ocid1.autonomousdatabase.oc1.ap-tokyo-1.abxhiljr6ifb5niyrvqnhmer
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PChome Cloud2
Mason978
HWTWLab
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Overview » Autonomous Database » Autonomous Database Details
ATP
AVAILABLE
Oracle ORDS
DB Connection
Perform
Autonomous Database
General Inform
Database Name: ords
Workload Type: Transac
Compartment: hktwlab (
OCID: ...ifngxq Show Co
Created: Tue, Jul 28, 20
OCPU Count: 1
Storage: 1 TB
License Type: Bring Your Own License (BYOL)
Database Version: 19c
Auto Scaling: Enabled
Lifecycle State: Available
Instance Type: Paid
Mode: Read/Write Edit
Database Connection
Help
Close
You will need the client credentials and connection information to connect to your database.The client credentials include the wallet, which is required for all types of connections.
Download Client Credentials (Wallet)
To download your client credentials, select the type of wallet, then click Download Wallet. You will be asked to create a password for the wallet.
Wallet Type
Instance Wallet
Download Wallet
Rotate Wallet
Wallet last rotated: -
Close
UTC
Network
Access Type: Allow secure access from everywhere
Access Control List: Disabled Edit
Maintenance
Next Maintenance: Sat, Oct 31, 2020, 04:00:00 UTC - 08:00:00 UTC
Data Safe
Status: Not Registered Register
Terms of Use and Privacy
Cookie Preferences
Copyright © 2020, Oracle and/or its affiliates. All rights reserved.

Copy ADW wallets

```
$ scp ./Wallet_ords.zip opc@158.101.144.184:/tmp
$ ssh -i ./oci_key.ppk opc@158.101.144.184
$ sudo su -
# mkdir /etc/oracle/graph/wallets
# cd /etc/oracle/graph
# unzip /tmp/Wallet_graph.zip /etc/oracle/graph/wallets

Look at tnsnames.ora under /etc/oracle/graph/wallets
# cd /etc/oracle/graph
# vi pgx.conf
```

修改pgx.conf – 權限設定

```
"pgx_role": "GRAPH_DEVELOPER",
"pgx_permissions": [
  {
    "grant": "PGX_SESSION_CREATE"
  },
  {
    "grant": "PGX_SESSION_NEW_GRAPH"
  },
  {
    "grant": "PGX_SESSION_GET_PUBLISHED_GRAPH"
  },
  {
    "grant": "PGX_SESSION_ADD_PUBLISHED_GRAPH"
  },
```

修改pgx.conf – ADW連線設定

```
...
"pgx_realm": {
    "implementation": "oracle.pg.identity.DatabaseRealm",
    "options": {
      "jdbc_url": "jdbc:oracle:thin:@graph_high?TNS_ADMIN=/etc/oracle/graph/wallets",
      "token_expiration_seconds": 14400,
      "connect_timeout_milliseconds": 10000,
      "max_pool_size": 64,
      "max_num_users": 512
    }
...
```

Restart PGX

```
$ sudo systemctl restart pgx
```


Autonomous Data Warehouse

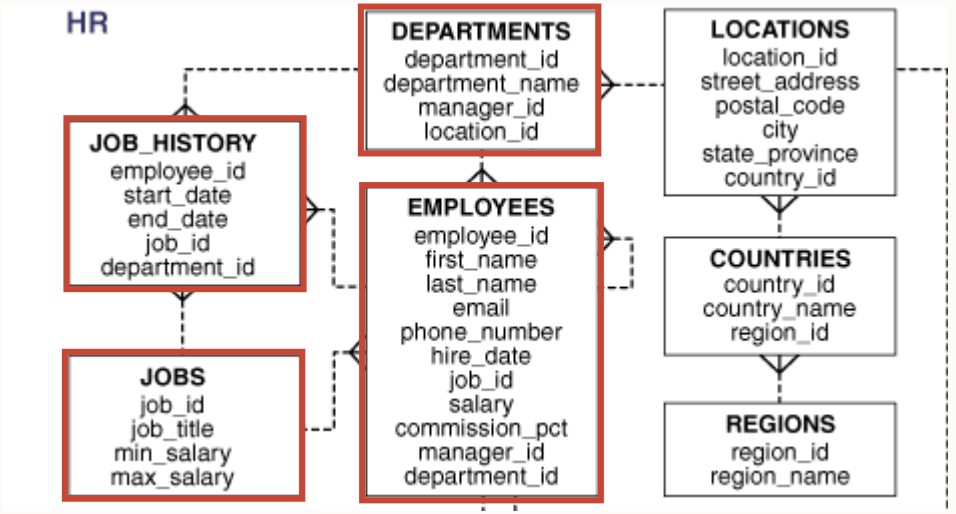
User Creation

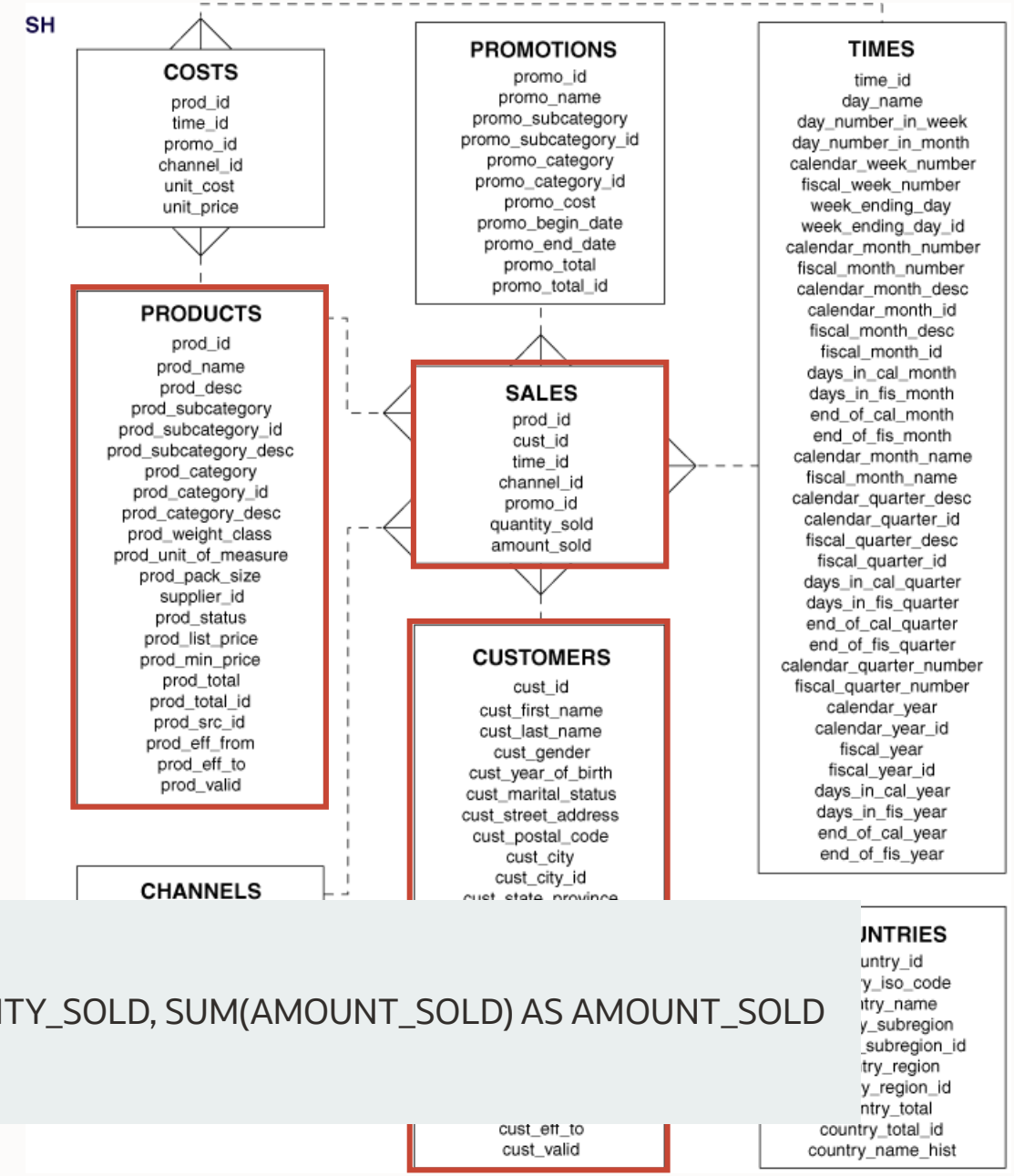
```
SQL> CREATE USER oraclegraph
  2  IDENTIFIED BY "HKTWLab@oracl3.com"
  3  DEFAULT TABLESPACE DATA
  4  QUOTA UNLIMITED ON DATA
  5  TEMPORARY TABLESPACE TEMP;
User ORACLEGRAPH created.
SQL> GRANT ALTER SESSION,CREATE PROCEDURE,CREATE SESSION,CREATE TABLE, CREATE TYPE to oraclegraph;
Grant succeeded.
SQL> CREATE ROLE GRAPH_DEVELOPER;
Role GRAPH_DEVELOPER created.
SQL> CREATE ROLE GRAPH_ADMINISTRATOR;
Role GRAPH_ADMINISTRATOR created.
SQL> GRANT GRAPH_DEVELOPER to oraclegraph;
Grant succeeded.
SQL> GRANT GRAPH_ADMINISTRATOR to oraclegraph;
Grant succeeded.
```

Login SQL Developer

```
CREATE ROLE graph_developer;
CREATE ROLE graph_administrator;
create user oraclegraph identified by HKTWLab@oracl3.com default tablespace data temporary tablespace temp;
ALTER USER ORACLEGRAPH QUOTA UNLIMITED ON DATA;
GRANT ALTER SESSION,CREATE PROCEDURE,CREATE SEQUENCE,CREATE SESSION,CREATE TABLE,CREATE TRIGGER,CREATE TYPE,CREATE VIEW to ORACLEGRAPH;
GRANT graph_developer to oraclegraph;
GRANT select on HR.employees to oraclegraph;
GRANT select on HR.jobs  to oraclegraph;
GRANT select on HR.departments  to oraclegraph;
GRANT select on HR.job_history  to oraclegraph;
GRANT select on HR.countries to oraclegraph;
GRANT select on HR.regions to oraclegraph;
```

Sample Schema HR, SH






```
CREATE TABLE SALES
AS
select CUST_ID, PROD_ID, SUM(QUANTITY_SOLD) as QUANTITY_SOLD, SUM(AMOUNT_SOLD) AS AMOUNT_SOLD
from sh.sales
group by CUST_ID, PROD_ID;
```

Graph Model: HR

Create Graph in PGX from Database Tables

PGQL Create Graph from Database Tables

```
[opc@pgx ~]$ /opt/oracle/graph/bin/opg-jshell --base_url https://localhost:7007 --username oraclegraph

enter password for user oraclegraph (press Enter for no password):
For an introduction type: /help intro
Oracle Graph Server Shell 20.4.0
Variables instance, session, and analyst ready to use.
opg-jshell> String statement =
...> "CREATE PROPERTY GRAPH hr_simplified "+
...> "  VERTEX TABLES ( "+
...> "    hr.employees LABEL employee "+
...> "      PROPERTIES ARE ALL COLUMNS EXCEPT ( job_id, manager_id, department_id ), "+
...> "    hr.departments LABEL department "+
...> "      PROPERTIES ( department_id, department_name ) "+
...> "  ) "+
...> "  EDGE TABLES ( "+
...> "    hr.employees AS works_at "+
...> "      SOURCE KEY ( employee_id ) REFERENCES employees "+
...> "      DESTINATION departments "+
...> "      PROPERTIES ( employee_id ) "+
...> "  )";
```

PGQL Query

```
statement ==> "CREATE PROPERTY GRAPH hr_simplified   VERTEX TABLES (     hr.employees LABEL employee       PROPERTIES ARE ALL
COLUMNS EXCEPT ( job_id, manager_id, department_id ),     hr.departments LABEL department       PROPERTIES ( department_id,
department_name )   )   EDGE TABLES (     hr.employees AS works_at       SOURCE KEY ( employee_id ) REFERENCES employees
DESTINATION departments       PROPERTIES ( employee_id )   )"

opg-jshell> session.executePgql(statement);

$6 ==> null

opg-jshell> PgxGraph g = session.getGraph("HR_SIMPLIFIED");

g ==> PgxGraph[name=HR_SIMPLIFIED,N=134,E=106,created=1603952305636]

opg-jshell> String query =
...> "SELECT dep.department_name "+
...> "FROM MATCH (emp:Employee) -[:works_at]-> (dep:Department) "+
...> "WHERE emp.first_name = 'Nandita' AND emp.last_name = 'Sarchand' "+
...> "ORDER BY 1";

query ==> "SELECT dep.department_name FROM MATCH (emp:Employee) -[:works_at]-> (dep:Department) WHERE emp.first_name =
'Nandita' AND emp.last_name = 'Sarchand' ORDER BY 1"
```

PGQL Query

```
opg-jshell> PgqlResultSet resultSet = g.queryPgql(query);
resultSet ==> PgqlResultSetImpl[graph=HR_SIMPLIFIED,numResults=1]
opg-jshell> resultSet.print();
+-----------------+
| department_name |
+-----------------+
| Shipping        |
+-----------------+
$10 ==> PgqlResultSetImpl[graph=HR_SIMPLIFIED,numResults=1]
opg-jshell> String query =
...> "SELECT label(n), COUNT(*) "+
...> "FROM MATCH (n) "+
...> "GROUP BY label(n) "+
...> "ORDER BY COUNT(*) DESC";
query ==> "SELECT label(n), COUNT(*) FROM MATCH (n) GROUP BY label(n) ORDER BY COUNT(*) DESC"
opg-jshell> PgqlResultSet resultSet = g.queryPgql(query);
resultSet ==> PgqlResultSetImpl[graph=HR_SIMPLIFIED,numResults=2]
```

PGQL Query

```
opg-jshell> resultSet.print();
+----------------------+
| label(n)   | COUNT(*) |
+----------------------+
| EMPLOYEE   | 107      |
| DEPARTMENT | 27       |
+----------------------+
$13 ==> PgqlResultSetImpl[graph=HR_SIMPLIFIED,numResults=2]
opg-jshell> String query =
...> "SELECT label(n) AS srcLbl, label(e) AS edgeLbl, label(m) AS dstLbl, COUNT(*) "+
...> "FROM MATCH (n) -[e]-> (m) "+
...> "GROUP BY srcLbl, edgeLbl, dstLbl "+
...> "ORDER BY COUNT(*) DESC";
query ==> "SELECT label(n) AS srcLbl, label(e) AS edgeLbl, label(m) AS dstLbl, COUNT(*) FROM MATCH (n) -[e]-> (m) GROUP BY
srcLbl, edgeLbl, dstLbl ORDER BY COUNT(*) DESC"
opg-jshell> PgqlResultSet resultSet = g.queryPgql(query);
resultSet ==> PgqlResultSetImpl[graph=HR_SIMPLIFIED,numResults=1]
```

PGQL Query

```
opg-jshell> resultSet.print();
+-------------------------------------------+
| srcLbl   | edgeLbl  | dstLbl     | COUNT(*) |
+-------------------------------------------+
| EMPLOYEE | WORKS_AT | DEPARTMENT | 106      |
+-------------------------------------------+
$16 ==> PgqlResultSetImpl[graph=HR_SIMPLIFIED,numResults=1]
opg-jshell> analyst.pagerank(g)
$17 ==> VertexProperty[name=pagerank,type=double,graph=HR_SIMPLIFIED]
opg-jshell> session.queryPgql("select m.FIRST_NAME, m.LAST_NAME, m.pagerank from HR_SIMPLIFIED match (m:EMPLOYEE) where
m.FIRST_NAME = 'Nandita'").print().close()
+-----------------------------------------------------+
| m.FIRST_NAME | m.LAST_NAME | m.pagerank             |
+-----------------------------------------------------+
| Nandita      | Sarchand    | 0.001119402985074627 |
+-----------------------------------------------------+
```

PGQL Query

```
opg-jshell> session.queryPgql("select m.DEPARTMENT_NAME, m.pagerank from HR_SIMPLIFIED match (m:DEPARTMENT) order by
m.pagerank ").print().close();
+-----------------------------------------------+
| m.DEPARTMENT_NAME    | m.pagerank             |
+-----------------------------------------------+
| Government Sales     | 0.001119402985074627   |
| Retail Sales         | 0.001119402985074627   |
| Manufacturing        | 0.001119402985074627   |
| Contracting          | 0.001119402985074627   |
| Corporate Tax        | 0.001119402985074627   |
| IT Support           | 0.001119402985074627   |
| NOC                  | 0.001119402985074627   |
| Control And Credit   | 0.001119402985074627   |
| Construction         | 0.001119402985074627   |
| Recruiting           | 0.001119402985074627   |
| Payroll              | 0.001119402985074627   |
| Shareholder Services | 0.001119402985074627   |
| IT Helpdesk          | 0.001119402985074627   |
| Benefits             | 0.001119402985074627   |
| Treasury             | 0.001119402985074627   |
| Accounting           | 0.001119402985074627   |
| Public Relations     | 0.002070895522388596   |
```

PGQL Query

```
opg-jshell> g.publish(VertexProperty.ALL, EdgeProperty.ALL)
opg-jshell>
```

Graph Visualization – PGQL Graph Query

```
select e
match ()-[e]-()

Graph HR_SIMPLIFIED
SELECT emp, e, dep
MATCH (emp:EMPLOYEE) -[e:WORKS_AT]->
(dep:DEPARTMENT)
WHERE emp.FIRST_NAME = 'Nandita' AND
emp.LAST_NAME = 'Sarchand'

SELECT label(n), COUNT(*)
FROM MATCH (n)
GROUP BY label(n)
ORDER BY COUNT(*) DESC

SELECT label(n) AS srcLbl, label(e) AS edgeLbl,
label(m) AS dstLbl, COUNT(*)
FROM MATCH (n) -[e]-> (m)
GROUP BY srcLbl, edgeLbl, dstLbl
ORDER BY COUNT(*) DESC

select m.FIRST_NAME, m.LAST_NAME, m.pagerank
FROM MATCH (m:EMPLOYEE)
WHERE m.FIRST_NAME = 'Nandita'

select m.DEPARTMENT_NAME, m.pagerank
from HR_SIMPLIFIED
match (m:DEPARTMENT) order by m.pagerank
DESC
```

Online Retails Transactions

Graph Analysis for Recommendation

By Ryota Yamanaka

https://github.com/ryotayamanaka/oracle-pg/tree/master/graphs/online_retail

Java keytool to store password

Add a password for the ‘oraclegraph' connection

```
[opc@pgx ~]$ keytool -importpass -alias oraclegraph -keystore keystore.p12 -storetype
pkcs12
Enter keystore password:
Re-enter new password:
Enter the password to be stored:
Re-enter password:
```

Login Jshell with keystore

```
[opc@pgx ~]$ cd /opt/oracle/graph/
[opc@pgx graph]$ bin/opg-jshell --base_url https://localhost:7007 --username
oraclegraph --secret_store /home/opc/keystore.p12

enter password for user oraclegraph (press Enter for no password):

enter password for keystore /home/opc/keystore.p12:
For an introduction type: /help intro
Oracle Graph Server Shell 20.4.0
Variables instance, session, and analyst ready to use.
opg-jshell>
```

Graph Configuration config-tables-distinct.json

```
{
"jdbc_url":"jdbc:oracle:thin:@graph_high?TNS_ADMIN=/etc/oracle/graph/wallets",
 "username":"oraclegraph",
 "keystore_alias": "oraclegraph",
 "name":"retail",
 "vertex_providers": [
  {
   "name":"Customer",
   "format":"rdbms",
   "database_table_name":"CUSTOMERS",
   "key_column":"CUSTOMER_ID",
   "key_type":"string",
   "props":[
    {"name":"country", "type":"string"}
   ]
  },
  {
   "name":"Product",
   "format":"rdbms",
   "database_table_name":"PRODUCTS",
   "key_column":"STOCK_CODE",
   "key_type":"string",
   "props":[
    {"name":"description", "type":"string"}
   ]
  }
 ],
```

Graph Configuration config-tables-distinct.json


```
"edge_providers": [
  {
   "name":"has_purchased",
   "format":"rdbms",
   "database_table_name":"PURCHASES_DISTINCT",
   "key_column":"PURCHASE_ID",
   "source_column":"CUSTOMER_ID",
   "destination_column":"STOCK_CODE",
   "source_vertex_provider":"Customer",
   "destination_vertex_provider":"Product",
   "props":[
   ]
  },
  {
   "name":"purchased_by",
   "format":"rdbms",
   "database_table_name":"PURCHASES_DISTINCT",
   "key_column":"PURCHASE_ID",
   "source_column":"STOCK_CODE",
   "destination_column":"CUSTOMER_ID",
   "source_vertex_provider":"Product",
   "destination_vertex_provider":"Customer",
   "props":[
   ]
  }
 ]
}
```

Load Graph with graph configuration

```
opg-jshell> var graph =
session.readGraphWithProperties("/opt/oracle/graph/data/config-tables-
distinct.json","Online Retail")
graph ==> PgxGraph[name=Online Retail,N=8258,E=532452,created=1604072399247]
opg-jshell> graph.queryPgql("SELECT n.description MATCH (n:Product) LIMIT
3").print();
+------------------------------+
| n.description                |
+------------------------------+
| GREEN ROUND COMPACT MIRROR   |
| LA PALMIERA WALL THERMOMETER |
| SMALL HEART FLOWERS HOOK     |
+------------------------------+
$2 ==> PgqlResultSetImpl[graph=Online Retail,numResults=3]
```

PGQL Example

```
opg-jshell> graph.queryPgql(" SELECT ID(c), ID(p), p.description FROM MATCH (c)-
[has_purchased]->(p) WHERE ID(c) = 'cust_12353' ").print();
+-----------------------------------------------------------+
| ID(c)      | ID(p)      | description                     |
+-----------------------------------------------------------+
| cust_12353 | prod_37449 | CERAMIC CAKE STAND + HANGING CAKES |
| cust_12353 | prod_22890 | NOVELTY BISCUITS CAKE STAND 3 TIER |
| cust_12353 | prod_37446 | MINI CAKE STAND WITH HANGING CAKES |
| cust_12353 | prod_37450 | CERAMIC CAKE BOWL + HANGING CAKES  |
+-----------------------------------------------------------+
$3 ==> PgqlResultSetImpl[graph=Online Retail,numResults=4]
```

Run Personalized PageRank Analysis

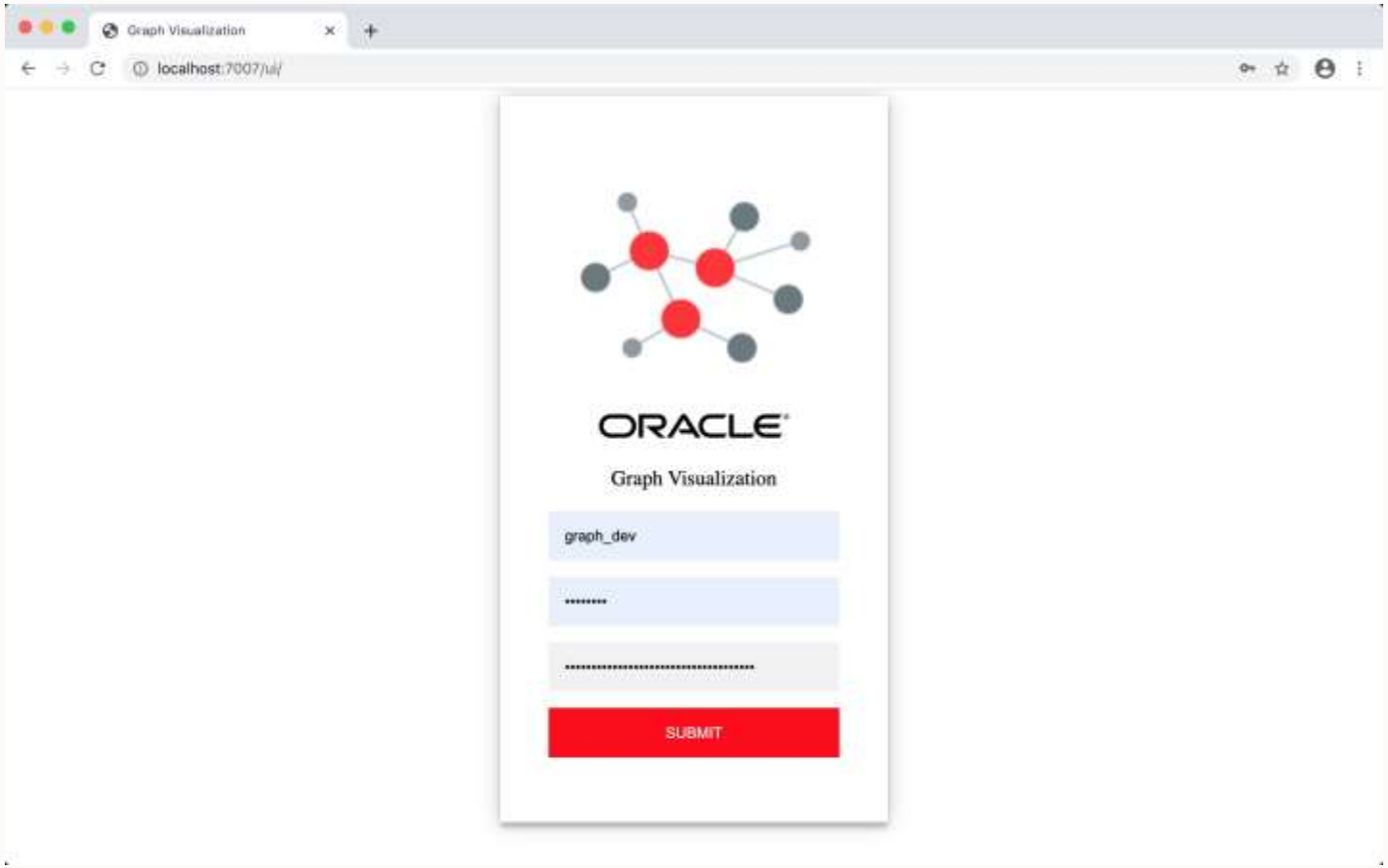
```
opg-jshell> var vertex = graph.getVertex("cust_12353");
vertex ==> PgxVertex[provider=Customer,ID=cust_12353]
opg-jshell> analyst.personalizedPagerank(graph, vertex);
$5 ==> VertexProperty[name=pagerank,type=double,graph=Online Retail]
opg-jshell>
```

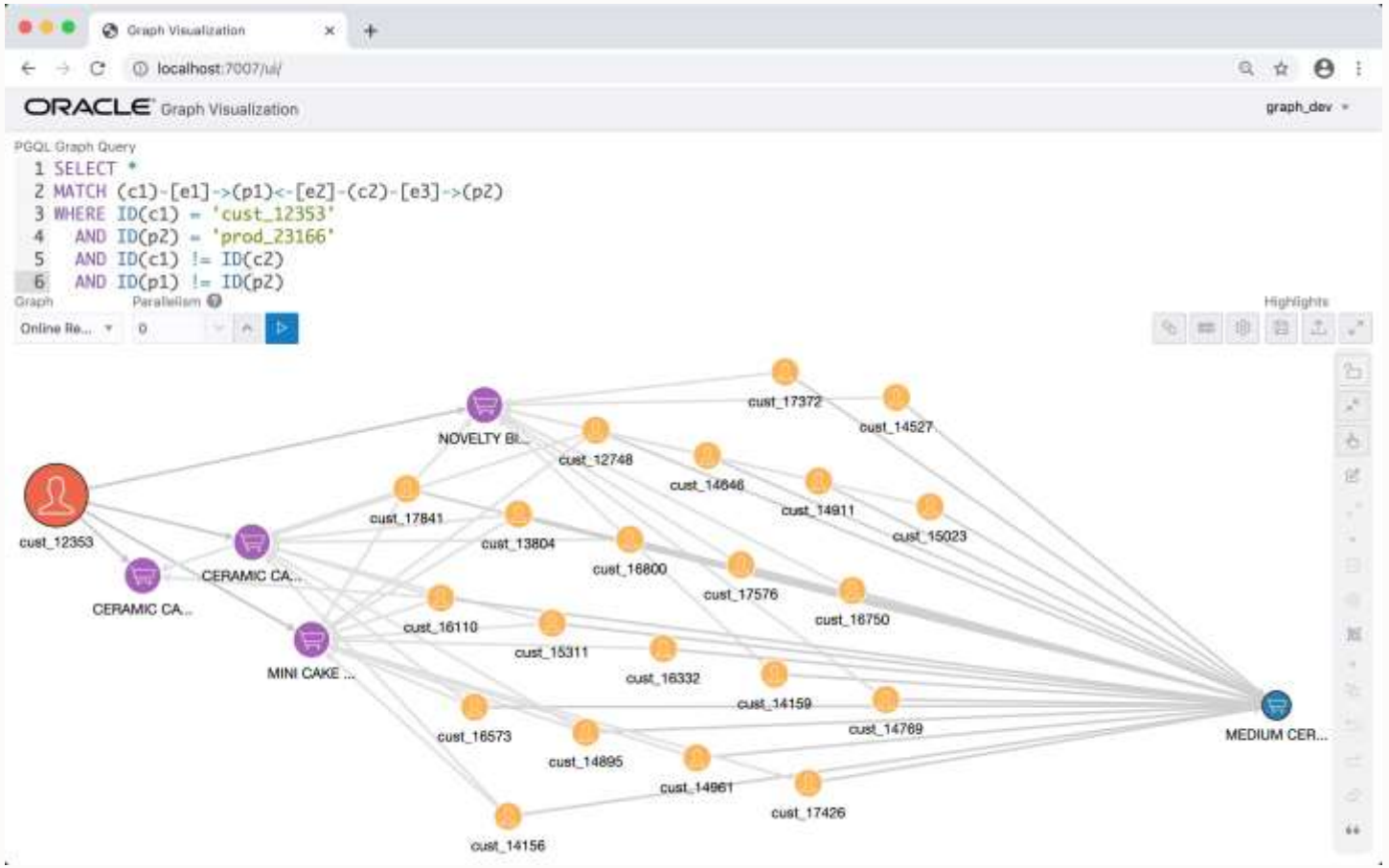
PGQL

```
opg-jshell> graph.queryPgql(
...> "  SELECT ID(p), p.description, p.pagerank " +
...> "  MATCH (p) " +
...> "  WHERE LABEL(p) = 'Product' " +
...> "    AND NOT EXISTS ( " +
...> "     SELECT * " +
...> "     MATCH (p)-[:purchased_by]->(a) " +
...> "     WHERE ID(a) = 'cust_12353' " +
...> "    ) " +
...> "  ORDER BY p.pagerank DESC" +
...> "  LIMIT 10"
...> ).print();
```

```
+-----------------------------------------------------------------------+
| ID(p)       | p.description                       | p.pagerank            |
+-----------------------------------------------------------------------+
| prod_22423  | REGENCY CAKESTAND 3 TIER            | 0.0013483656895780121 |
| prod_85123A | WHITE HANGING HEART T-LIGHT HOLDER  | 0.0013000764817371 68 |
| prod_21232  | STRAWBERRY CERAMIC TRINKET POT      | 0.0010642787031750 63 |
| prod_22720  | SET OF 3 CAKE TINS PANTRY DESIGN    | 9.98725982689145E-4   |
| prod_47566  | PARTY BUNTING                       | 8.80044605313488E-4   |
| prod_21231  | SWEETHEART CERAMIC TRINKET BOX      | 8.79318597457098 4E-4 |
| prod_21212  | PACK OF 72 RETROSPOT CAKE CASES     | 7.74948580210001E-4   |
| prod_84991  | 60 TEATIME FAIRY CAKE CASES         | 7.56165469450906 4E-4 |
| prod_85099B | JUMBO BAG RED RETROSPOT             | 7.25890414385824E-4   |
| prod_84879  | ASSORTED COLOUR BIRD ORNAMENT       | 7.22334915768975 7E-4 |
+-----------------------------------------------------------------------+
$6 ==> PgqlResultSetImpl[graph=Online Retail,numResults=10]
```

```
opg-jshell> session.getId();
$7 ==> "7363760b-2398-4a82-9554-e2e9bd5807f9"
opg-jshell>
```





```
SELECT *
MATCH (c1)-[e1]->(p1)<-[e2]-(c2)-[e3]->(p2)
WHERE ID(c1) = 'cust_12353'
  AND ID(p2) = 'prod_23166'
  AND ID(c1) != ID(c2)
  AND ID(p1) != ID(p2)
```

Our mission is to help people
see data in new ways, discover insights,
unlock endless possibilities.

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