

# DATABASE MICROSERVICE ARCHITECTURES

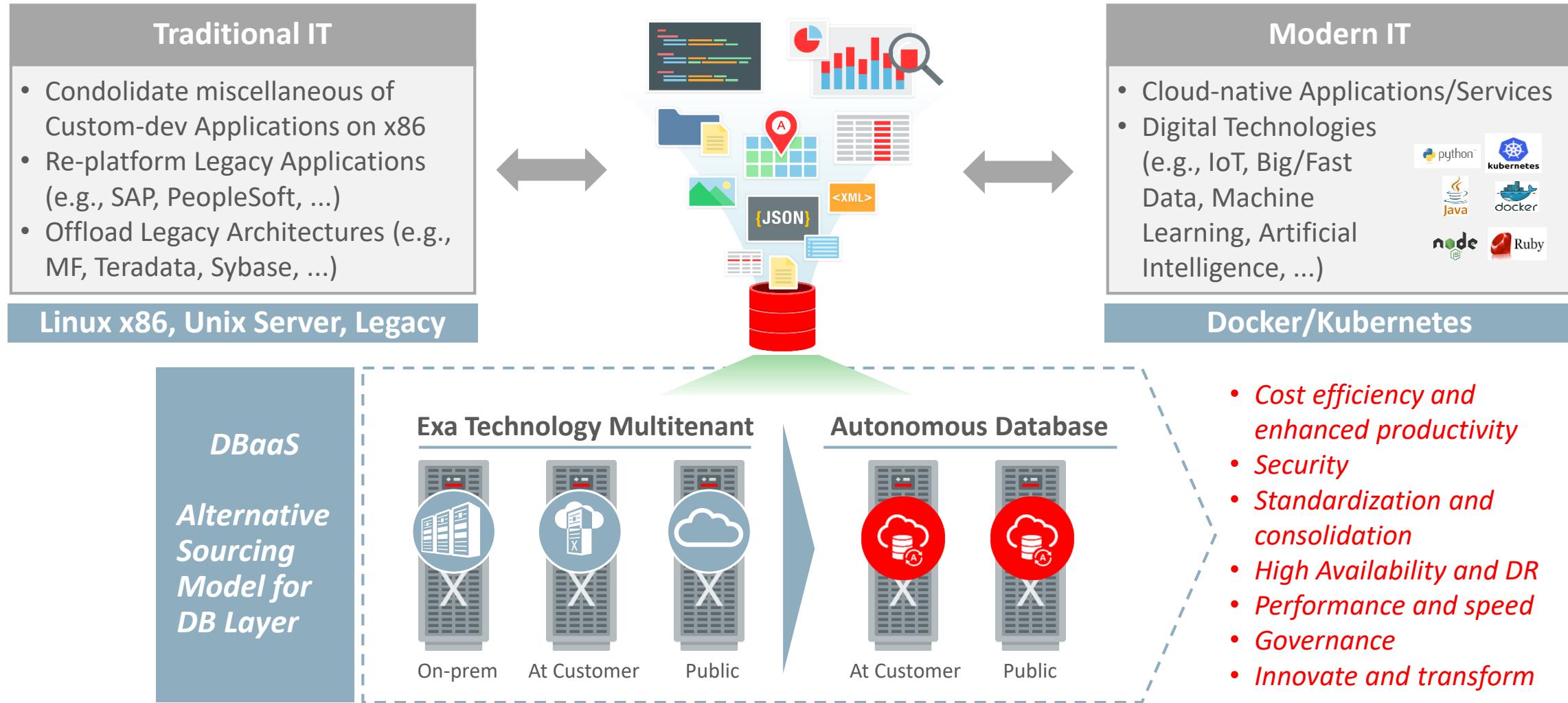
Taller – Telefónica España

Julio 2019

Oracle Ibérica

# Innovative and secured DBaaS Platform to support any kind of Application landscape

Benefits unlocked



Source: Oracle Insight

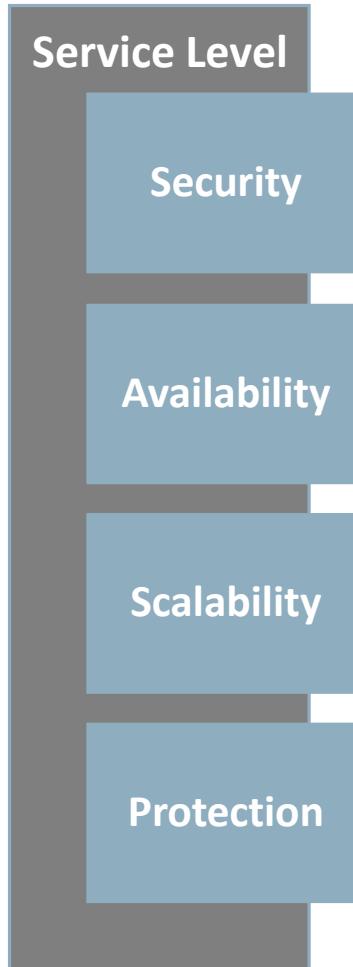
ORACLE®

# Simplify by standardizing to a well defined Service Catalog of Service Classes and Service Levels

Service Classes		Service Level		
OLTP	<ul style="list-style-type: none"><li>Row Level Locking</li><li>Distributed Transactional Consistency</li></ul> <ul style="list-style-type: none"><li>Fine Grade Auditing</li><li>Segregation of Duties</li></ul>	Bronze	Silver	Gold
Analytics	<ul style="list-style-type: none"><li>Columnar in Memory</li><li>Query Consistency</li><li>Columnar Compression</li><li>Virtual Private DB</li></ul> <ul style="list-style-type: none"><li>Columnar in Flash</li><li>Query Offloading</li><li>Shared Nothing Scalability</li></ul>	Performances	Performances	Performances
Cloud Native	<ul style="list-style-type: none"><li>Multi Semantic Model</li><li>Multi Access Interface</li><li>Open Service Broker Integration</li></ul> <ul style="list-style-type: none"><li>SODA and ORDS</li><li>On Demand Provisioning</li></ul>	Availability	Availability	Availability
Legacy	<ul style="list-style-type: none"><li>Old Versions</li><li>Access Control</li></ul> <ul style="list-style-type: none"><li>Transparent Data Encryption</li></ul>	Cold Backup No RAC Continuity No DR No RTO RPO 1 day	Hot Backup RAC Continuity No DR RTO weeks RPO hours	Hot Backup Hot RAC Continuity DR RTO day RPO minutes

Source: Oracle Presales

# Key Capabilities for Service Level definition

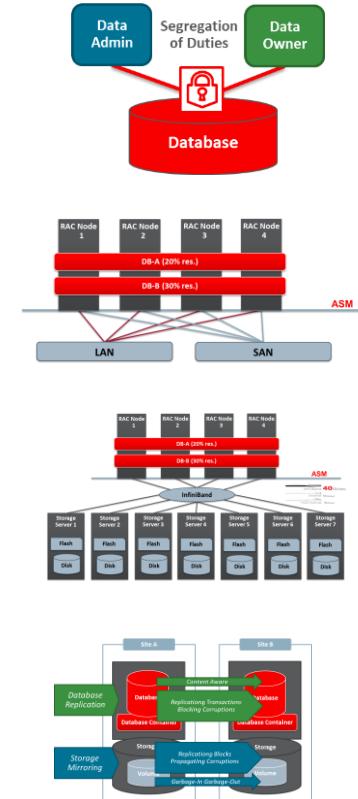


## Key requirements

- Segregation of duties between Data Admin and Data Owner
- Maximum availability with transparent failures to Applications ...
  - ... keeping distributed consistency
- Avoiding the Storage bottleneck allowing unlimited scalability ...
  - ... keeping distributed consistency
- Avoid propagation of data corruptions with storage-based replication ...
  - ... also unlocking other benefits (bandwidth and IOPS costs, SLA)

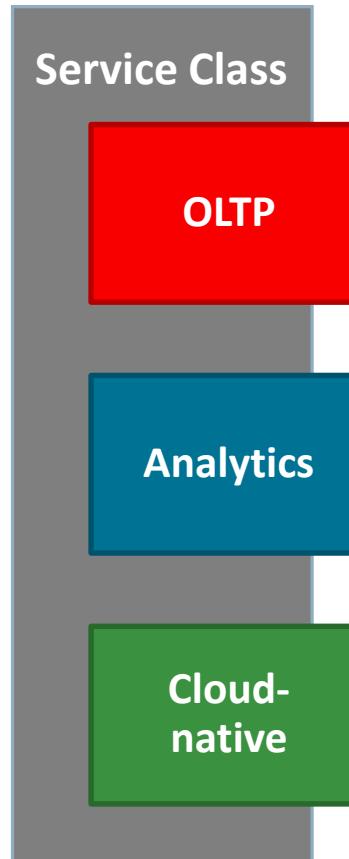
## Oracle enablers

- DB Vault for Segregation of Duties
- Real Application Cluster
- Exadata Technology
- DB-level data replication (Active Data Guard and Data Guard)



Source: Oracle Insight

# Key Functionalities for Service Class definition

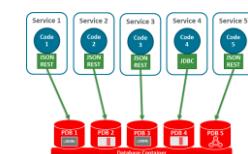
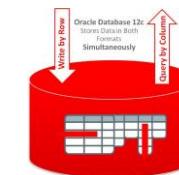
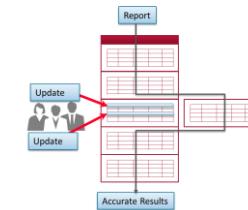


## Key requirements

- Consistency required not only for transactional workloads, but also for real-time changing analytics
- In-memory capability transparent to Applications
- Multi-model semantics ...
  - ... segregated services ...
  - ... in Enterprise Environment

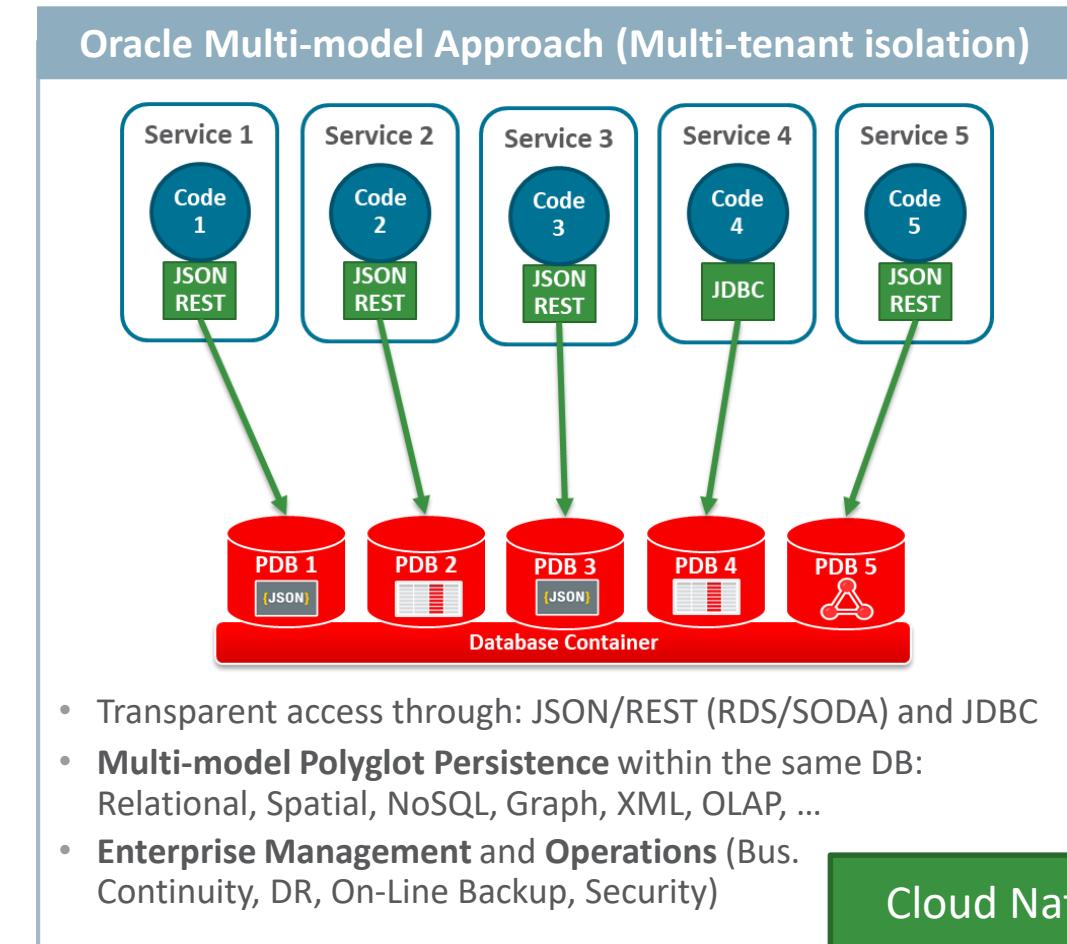
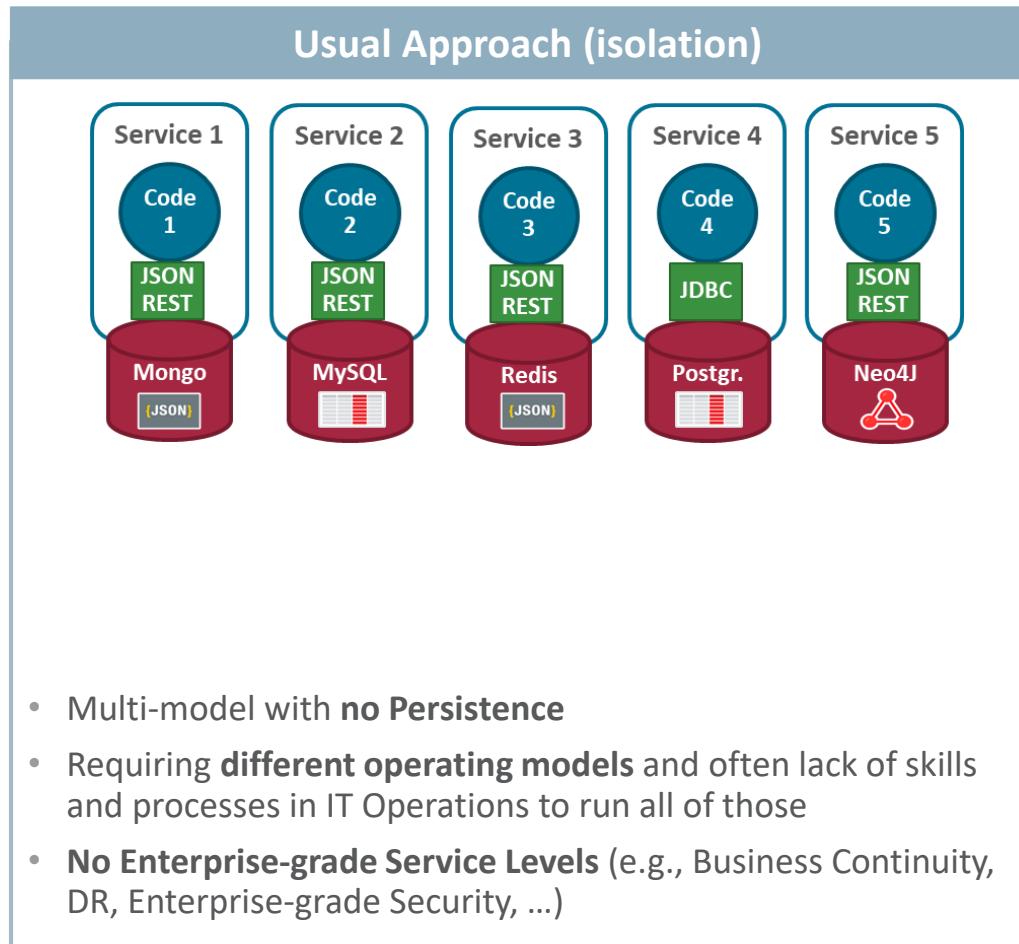
## Oracle enablers

- Oracle Relational DB: provide best consistency
- Oracle In-memory: ability to write by row and read by column simultaneously
- Oracle Relational DB: enterprise-grade multi-model and multi-tenant segregation



Source: Oracle Insight

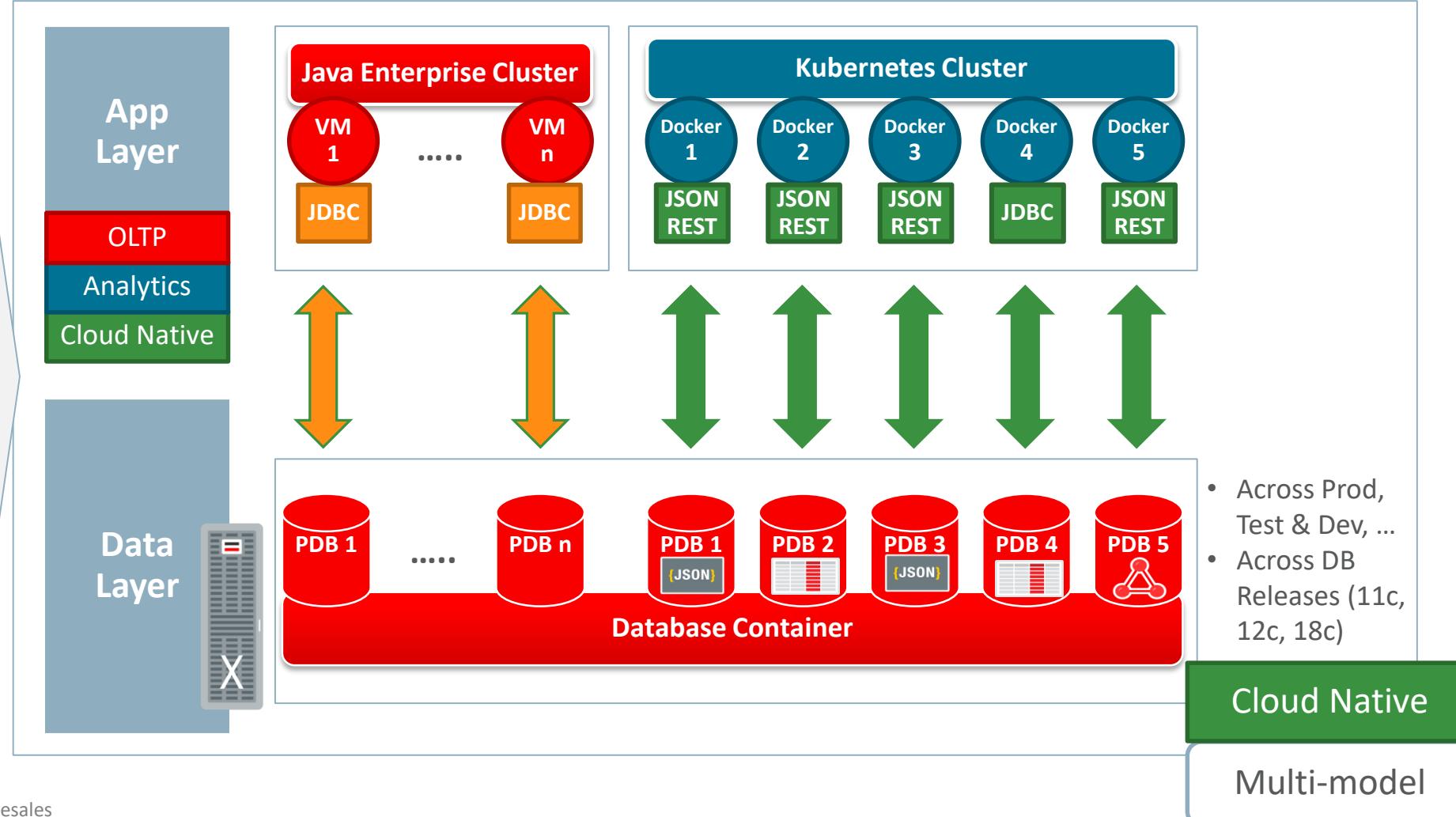
# Microservices with Poliglot persistence delivered and operated in an Enterprise Environment ...



Source: Oracle Presales

# ... by leveraging Exadata to implement a Modern Horizontal Grid Scalability

- Coexistence of Java Enterprise and Kubernetes
- Cross Model Data Access
- Gradual migrations avoiding big bang risky projects
- Unified Management and Operations
- Integrated comprehensive security



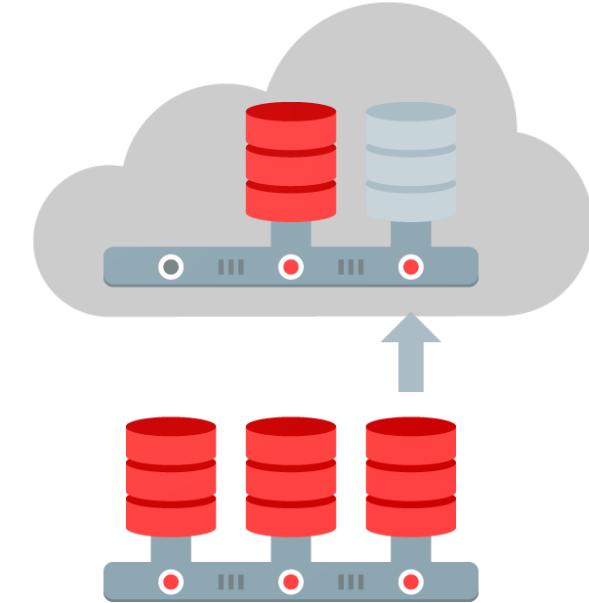
Source: Oracle Presales

# Contenido del Taller

- 1** *Creación de una BD Multitenant con varias PDBs*
- 2** *Copiado de PDBs mediante mecanismo de Clonado*
- 3** *Ejecución operacion interfaz REST sobre Base de Datos: ORDS*
- 4** *Creación de una operación SQL-PL/SQL e interfaces REST en ORDS*
- 5** *Despliegue ORDS Standalone en un entorno de Docker o K8s*
- 6** *Copia de datos entre PDBs mediante OGG*

# Multitenant

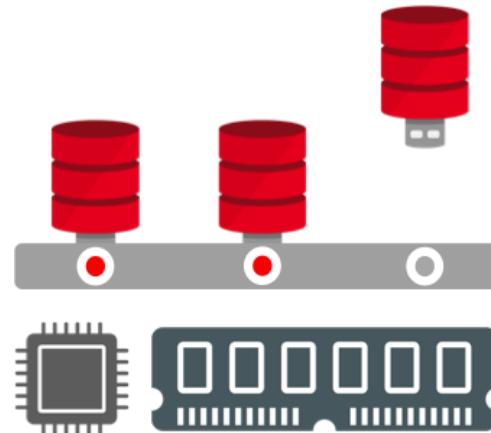
**4k PDBs, Hot Clone/Relocate/Refresh, Application Root**



# 12.1 Multitenant

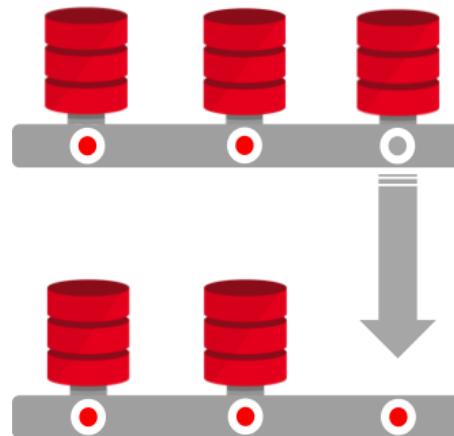
## Reduce CapEx and Opex by Half

### Cloud Scale Operations



Manage many as one  
CPU and I/O management

### Agility



Rapid provisioning and cloning  
Unplug/plug databases

### Software as a Service

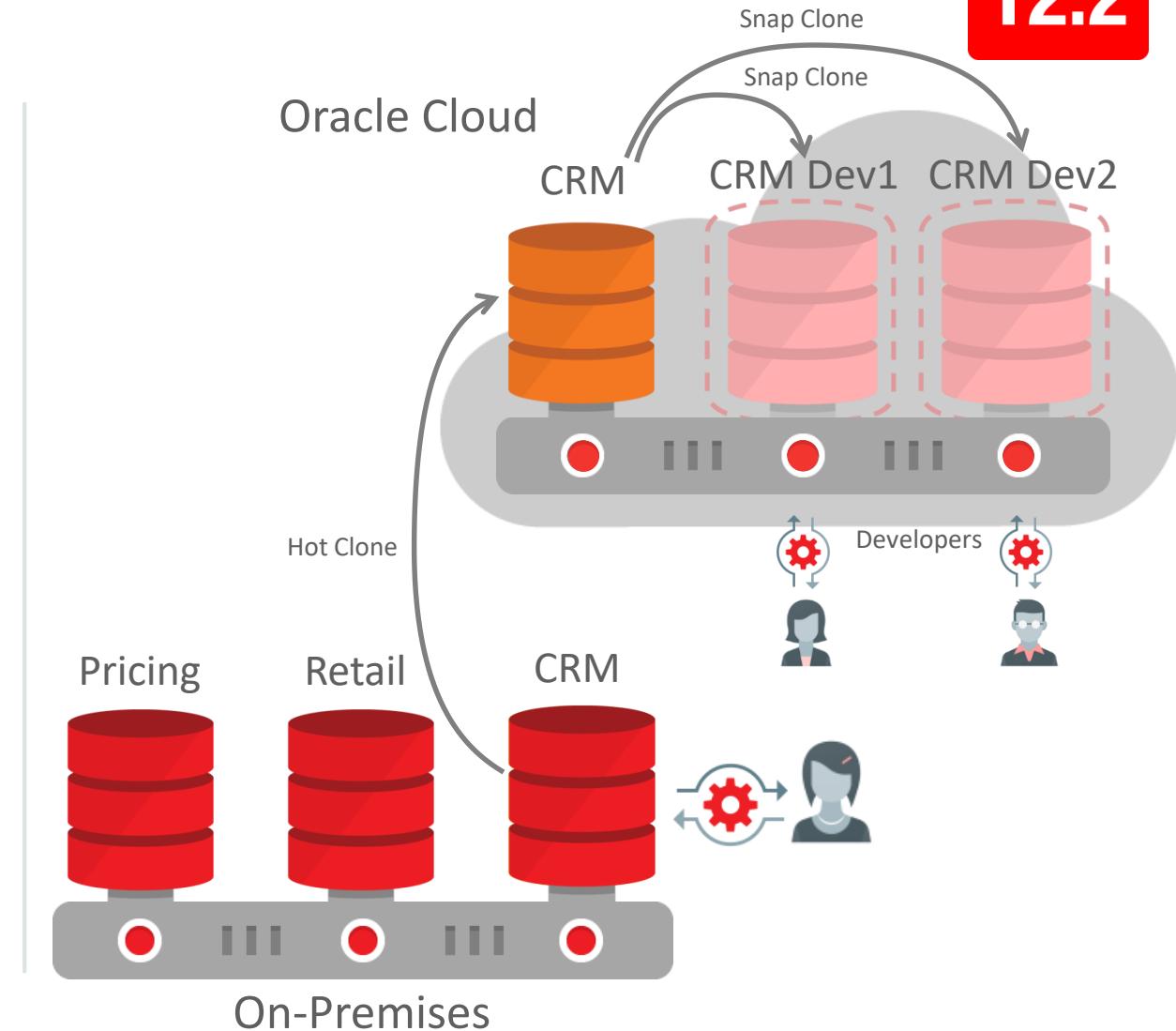


Instant SaaS architecture  
No application changes required

NEW IN  
12.2

# PDB Hot Clone

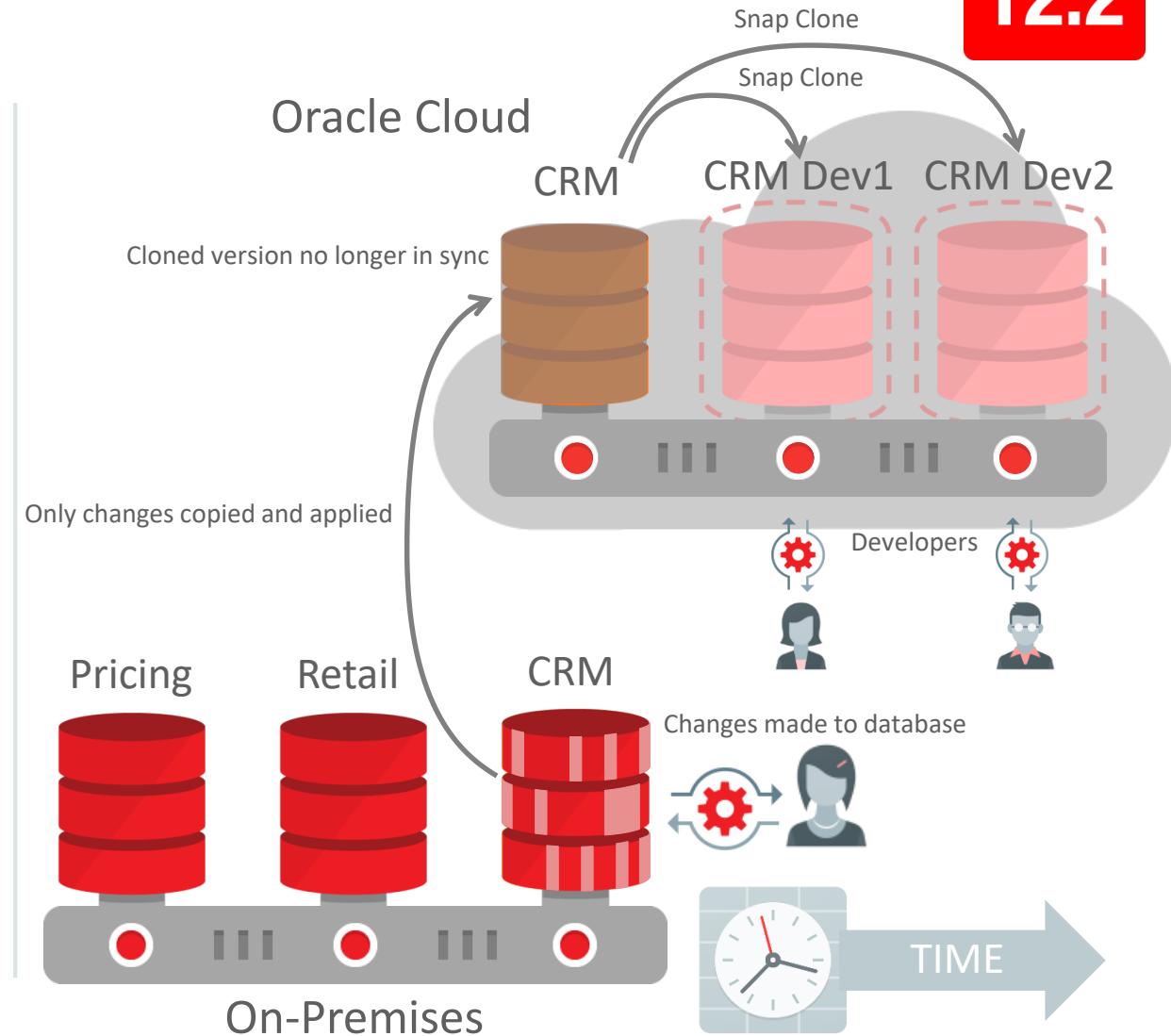
- PDB Hot Clone
  - Online test master instantiation



NEW IN  
12.2

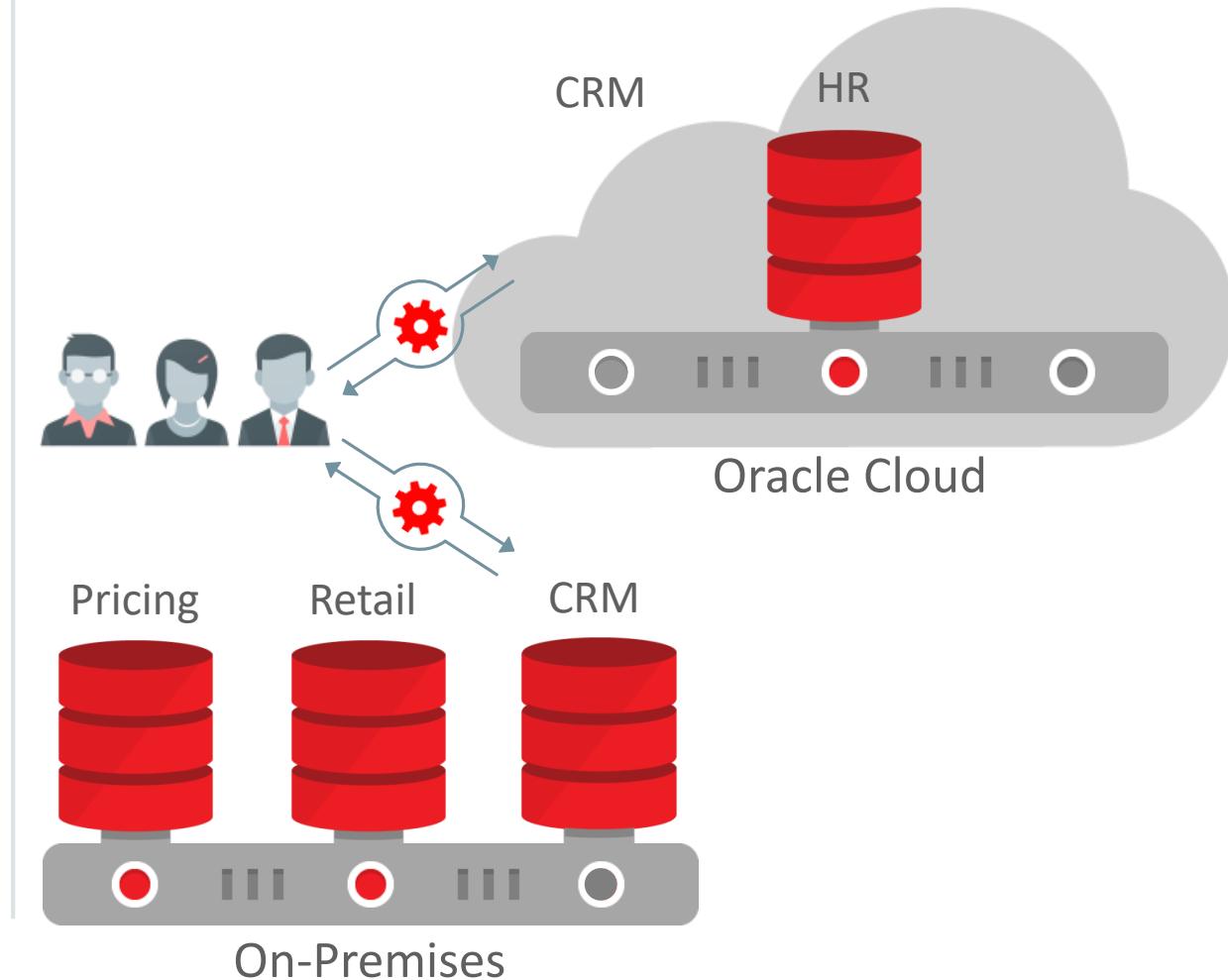
# PDB Refresh

- PDB Hot Clone
  - Online test master instantiation
- PDB Refresh
  - Incremental refresh of clone with latest data



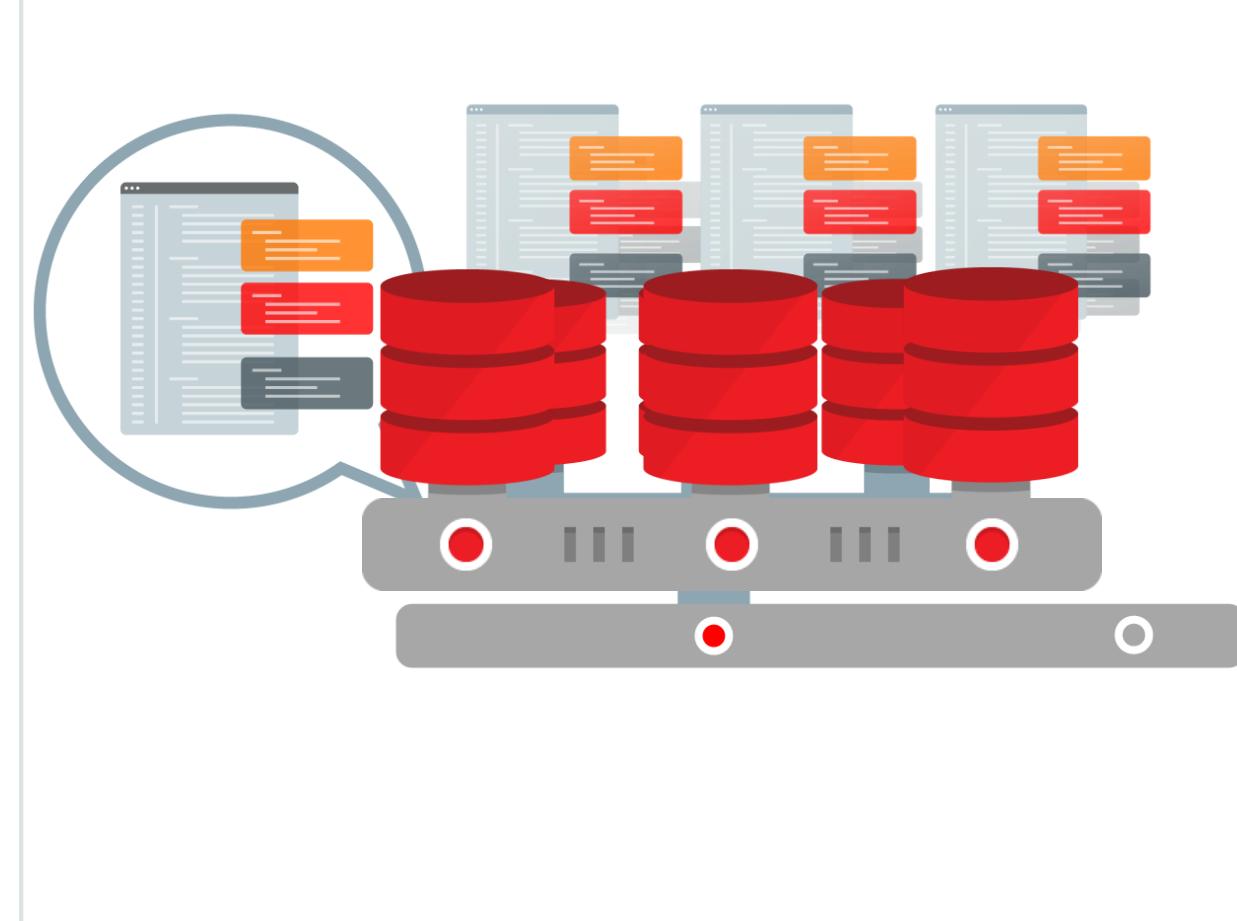
# PDB Relocate

- PDB Hot Clone
  - Online test master instantiation
- PDB Refresh
  - Incremental refresh of clone with latest data
- PDB Relocate
  - Relocate with no downtime



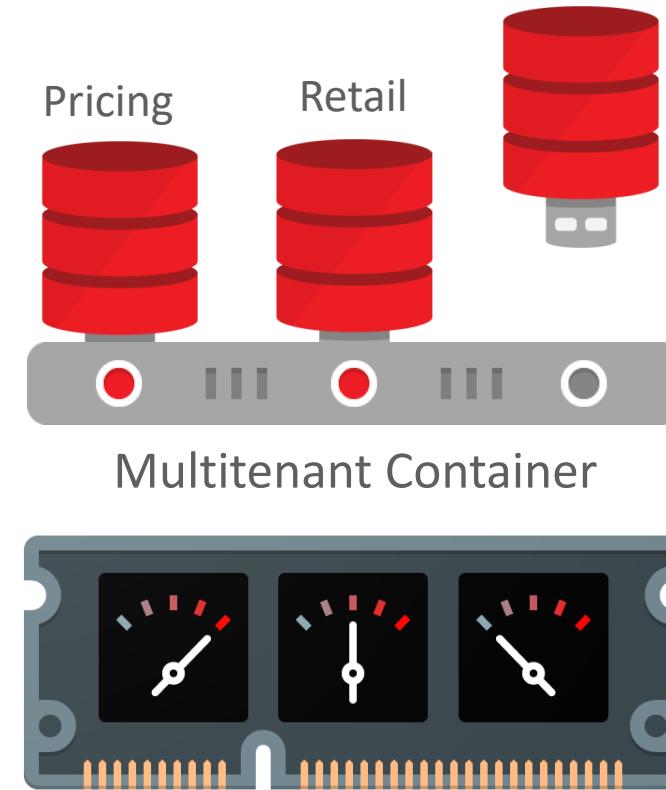
# Application Container

- PDBs share application objects
  - Code, metadata and data
- Further simplifies management
  - Apply updates to application container
- Suitable for SaaS-like applications



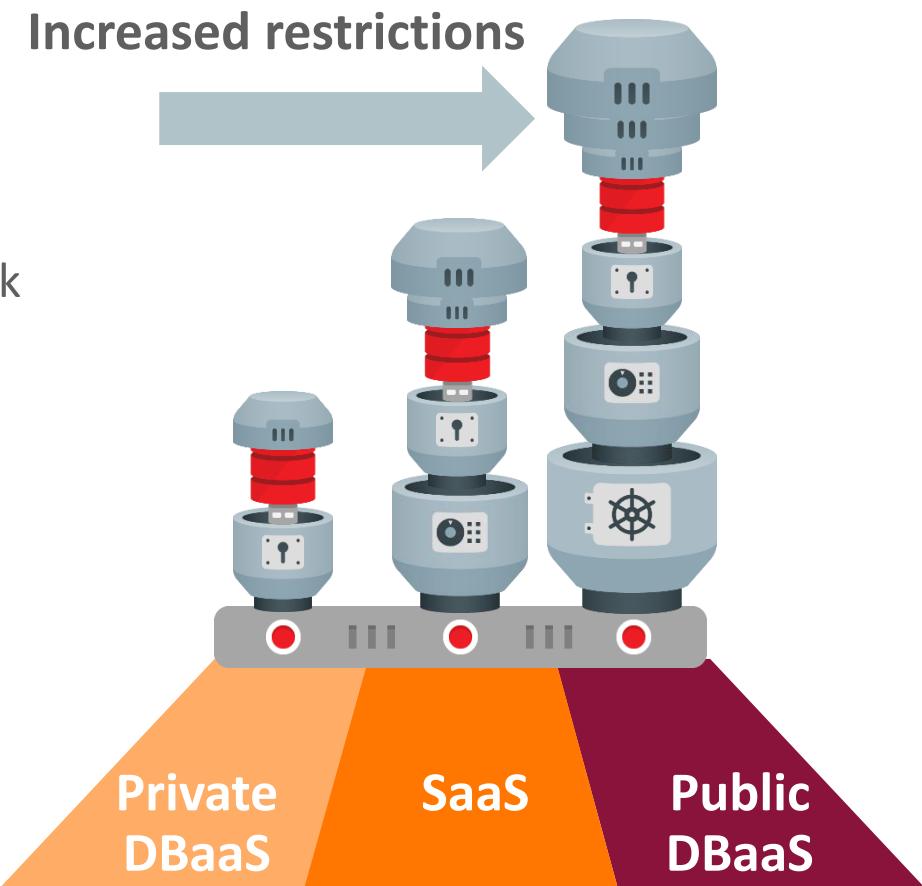
# Consolidation & Isolation at Scale

- PDBs per container increased from 252 to 4,096
- Memory resource prioritization in addition to CPU and I/O
- PDBs optimized for RAC
  - PDB lock domain



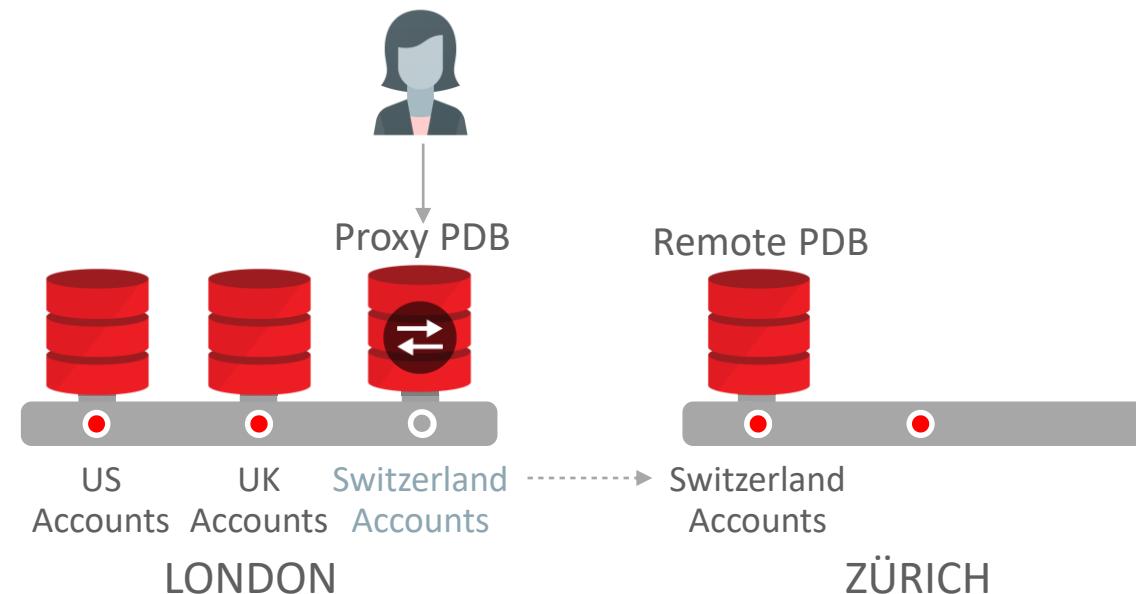
# Configurable Isolation

- Challenge
  - Economies of scale are achieved by sharing key infrastructure and memory components
  - Tenants (PDBs) not only share the host but also the OS, the network and common objects.
- Solution “PDB Lockdown Profiles” block access to
  - Network
  - Administrative features
  - Common users and objects
- Out of box profiles
  - Public DBaaS, SaaS, Private DBaaS



## More 12.2 Multitenant Innovations

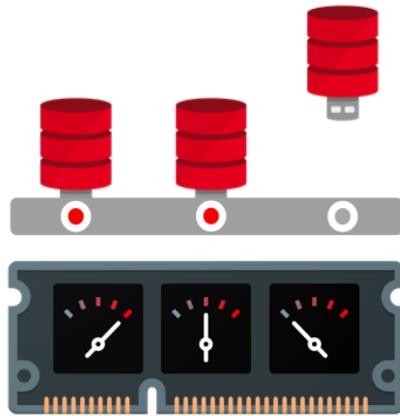
- Central CDB cloud provisioning framework
  - contains a catalog and PDB templates
- Proxy PDBs
  - provides local context for remote PDB for location transparency



# Multitenant with Oracle Database 12c Release 2

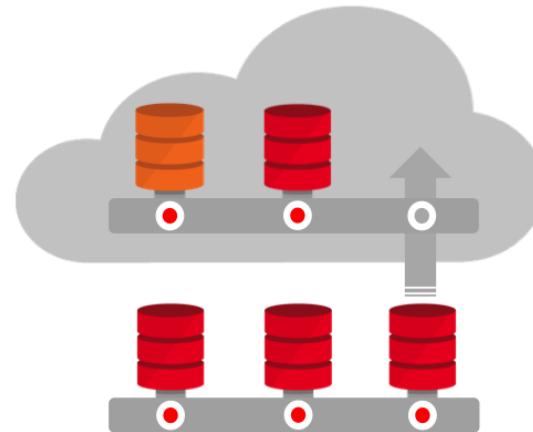
## Summary

### Cloud Scale Operations



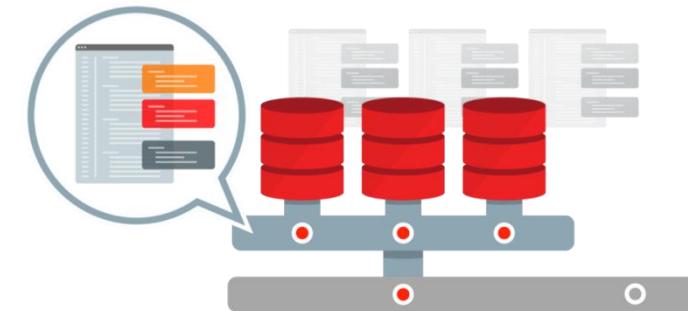
- 12.1 Manage many as one  
CPU and I/O management
- 12.2 4,096 PDBs per CDB  
Memory management

### Agility



- Rapid provisioning and cloning
- Unplug/plug databases
- Hot cloning & PDB clone refresh
- Online tenant relocation

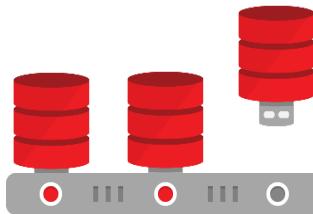
### Software as a Service



- Instant SaaS architecture
- No application changes required
- Shared application objects
- Online tenant relocation

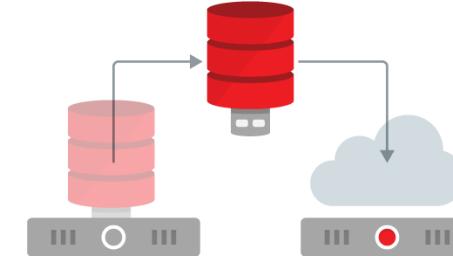
# Multitenant

12.1



- Container managed database virtualization
- Manage Many as one
  - Patching, Backup, Security, Online Cloning, Online Relocation
- Software as Service
  - Shared metadata, Data location transparency

12.2, 18c, 19c

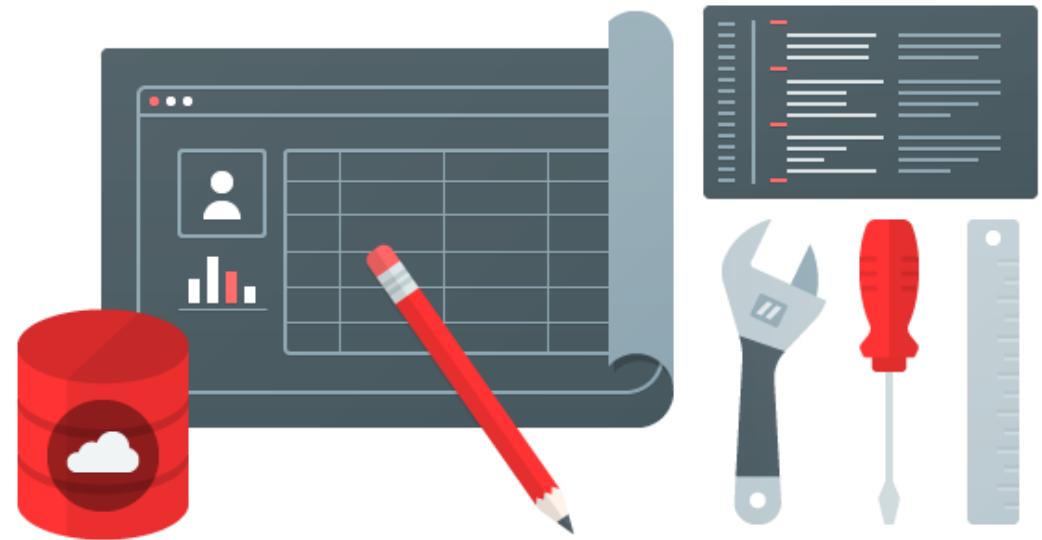


- 12.2
  - Online cloning & relocation
  - Incremental refresh of test/dev master
  - Application containers
- 18c
  - Transportable backups
  - Snapshot carousel
  - Refreshable PDB switchover
- 19c
  - RAT and ADDM at PDB level

# Taller:

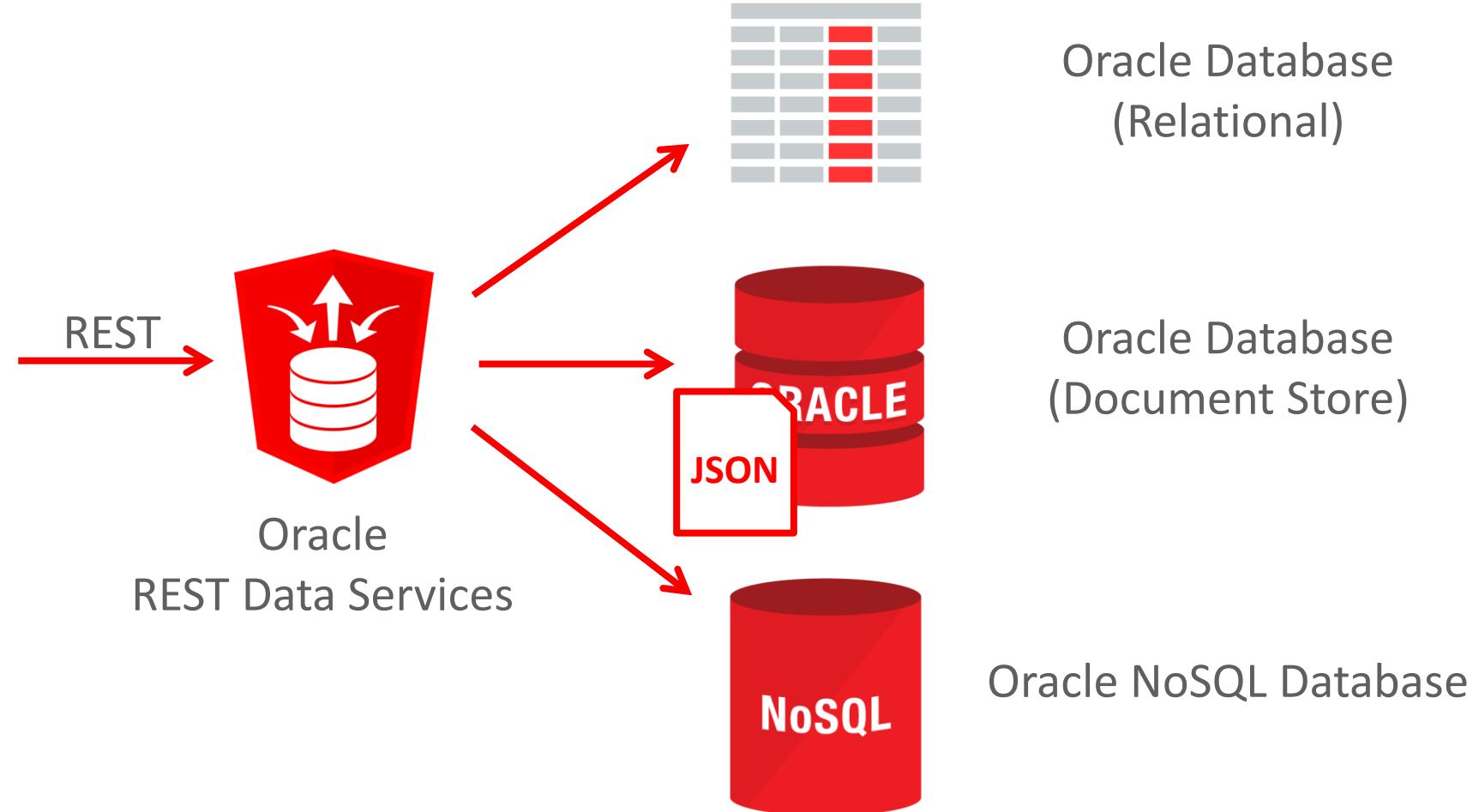
- Create PDB: `create_pdb.txt`
- Clone PDB: `clone_pdb.txt`

# ORACLE REST DATA SERVICES



# Oracle REST Data Services

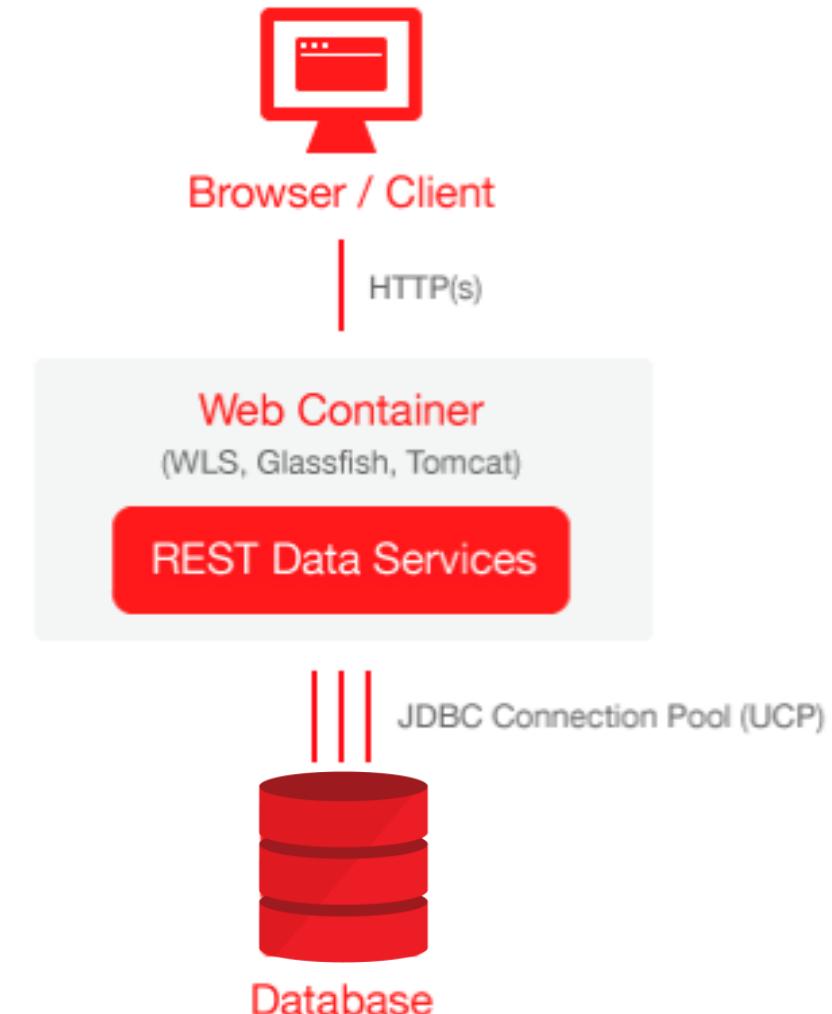
## REST-enable your data



# Oracle Database Cloud Service

## Oracle REST Data Services

- Available **Standalone (Jetty)**, Weblogic, Tomcat & Glassfish
- Turns Database Service into an RESTful API service
- Fully provisioned and functional in all cloud editions
- Available in 11g, 12c and 18c, **no extra cost**
- Allows publishing of URI based access to Oracle database over REST
- Results in JSON or CSV
- Mapping of URI to SQL or PL/SQL
- All HTML methods GET, PUT, POST, DELETE, PATCH
- OAuth2 integration
- Highly scalable, can use all features of database



# Oracle REST Data Services

## ORDS powers the Schema Service, A Quick Detour

- Provides data access consistent with modern App Dev frameworks
  - Mid tier application
  - Can map standard http(s) RESTful gets and posts to SQL
  - Can declaratively returns results in JSON format
  - JavaScript friendly
  - Can support high numbers of end users
- Services
  - HTTP(s) relational data access
  - Oracle JSON collection based schema-less access
  - Oracle NoSQL access over HTTP
  - Oracle APEX mid-tier, web toolkit applications, mod\_plsql replacement
- Formally known as Oracle APEX Listener
- Supported feature of the Oracle Database since 2010
- Ships with Oracle Database 12.1.0.2



# Oracle REST Data Services

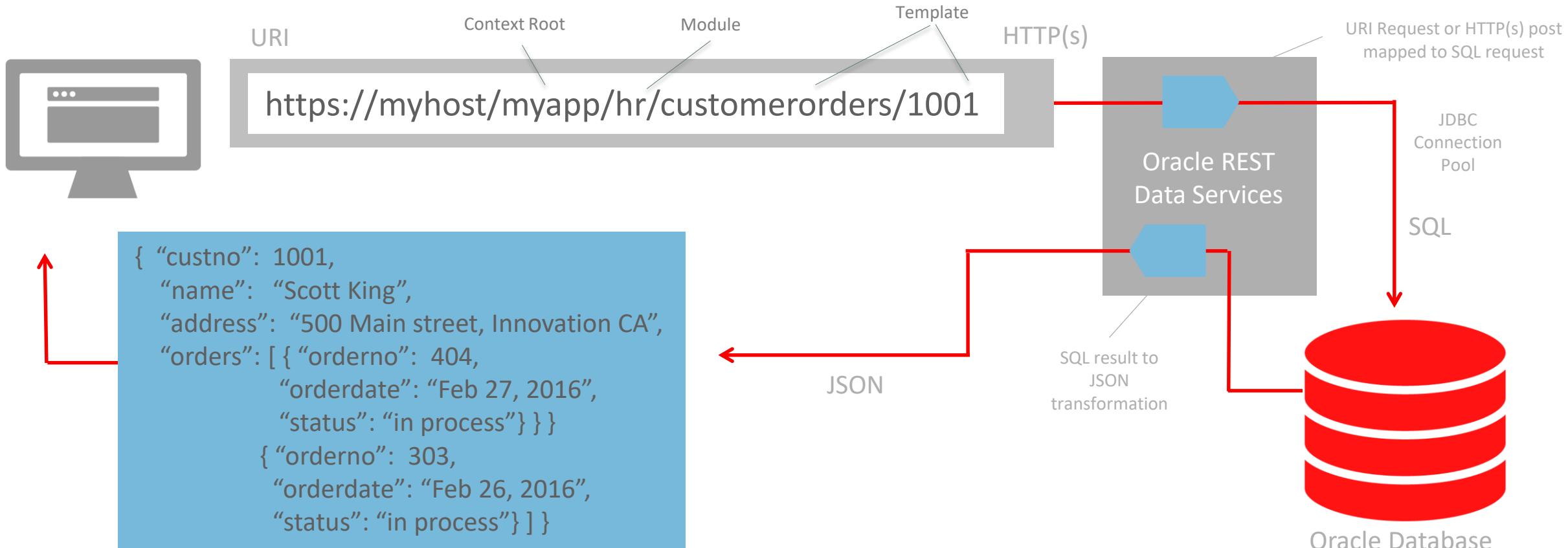
## Serving JSON results from relational data



- Data stored in standard relational tables and columns
- Oracle REST Data Services (ORDS) Developer defines **URI<>SQL** mapping
- App Developer calls named **URI** over **HTTP(S)** gets and posts

# Oracle REST Data Services

## HTTP(s) API App-Dev with Relational Tables in Oracle Database



ORDS maps standard URI requests to corresponding relational SQL (not schemaless): e.g. SQL SELECT from customers and orders table.

ORDS also transforms the SQL results into JavaScript Object Notation (JSON), other formats include HTML, binary and CSV.

Fully committed to supporting any and all standards required by Fusion / SaaS / FMW; we are actively engaged in the ongoing dialog.

# Oracle REST Data Services - Examples

```
BEGIN
ORDS.define_service(
  p_module_name    => 'module1',
  p_base_path      => 'mod1/',
  p_pattern        => 'channels/',
  p_method         => 'GET',
  p_source_type    => ORDS.source_type_collection_feed,
  p_source          => 'SELECT count(*) FROM sh.channels',
  p_items_per_page => 0);

  COMMIT;
END;
/
```

```
curl -i -k http://172.16.1.4:8080/ords/jsonpdb/sh/mod1/channels/
curl -i -k http://130.61.52.57:8080/ords/jsonpdb/sh/mod1/channels/
```

```
BEGIN
ORDS.define_service(
  p_module_name    => 'aggjson2',
  p_base_path      => 'aggjsoncomplex/',
  p_pattern        => 'crucejson/',
  p_method         => 'GET',
  p_source_type    => ORDS.source_type_collection_feed,
  p_source          => 'select ch.channel_desc, c.sales_json.TOTAL_SOLD+c1.sales_json.TOTAL_SOLD
from SALES_JSON_INDEX c,
      SALES_JSON_INDEX2 c1,
      CHANNELS ch
where c.sales_json.CHANNELID = ch.channel_id
and   c1.sales_json.CHANNELID = ch.channel_id
and   c.sales_json.CUSTID = c1.sales_json.CUSTID
and   c.sales_json.CUSTID = 397071',
  p_items_per_page => 0);

  COMMIT;
END;
/
```

```
curl -i -k http://172.16.1.4:8080/ords/jsonpdb/sh/aggjsoncomplex/crucejson
curl -i -k http://130.61.52.57:8080/ords/jsonpdb/sh/aggjsoncomplex/crucejson
```

# Oracle REST Data Services - Examples

```
CREATE OR REPLACE PROCEDURE create_sales (
P_PROD_ID      sales.prod_id%TYPE,
P_CUST_ID      sales.cust_id%TYPE,
P_TIME_ID      VARCHAR2,
P_CHANNEL_ID   sales.CHANNEL_ID%TYPE,
P_PROMO_ID     sales.PROMO_ID%TYPE,
P_QUANTITY SOLD    sales.QUANTITY_SOLD%TYPE,
P_SELLER       sales.SELLER%TYPE,
P_FULFILLMENT_CENTER sales.FULFILLMENT_CENTER%TYPE,
P_COURIER_ORG  sales.COURIER_ORG%TYPE,
P_TAX_COUNTRY   sales.TAX_COUNTRY%TYPE,
P_TAX_REGION    sales.TAX_REGION%TYPE,
P_AMOUNT SOLD   sales.AMOUNT_SOLD%TYPE
)
AS
BEGIN
  INSERT INTO sales (PROD_ID, CUST_ID, TIME_ID, CHANNEL_ID, PROMO_ID, QUANTITY_SOLD, SELLER, FULFILLMENT_CENTER, COURIER_ORG, TAX_COUNTRY, TAX_REGION,AMOUNT_SOLD )
  VALUES (
P_PROD_ID,
P_CUST_ID,
to_date(P_TIME_ID,'YYYY-MM-DD HH24:MI:SS'),
P_CHANNEL_ID,
P_PROMO_ID,
P_QUANTITY SOLD,
P_SELLER,
P_FULFILLMENT_CENTER,
P_COURIER_ORG,
P_TAX_COUNTRY,
P_TAX_REGION,
P_AMOUNT SOLD);
EXCEPTION
  --- Si hubiera PK, podríamos hacer un UPDATE en el caso de un POST de una clave ya existente !!!
  WHEN OTHERS THEN
    HTP.print(SQLERRM);
END create_sales;
/
```

# Oracle REST Data Services - Examples

```
BEGIN
ORDS.define_module(
  p_module_name    => 'postsales',
  p_base_path      => 'cresale/',
  p_items_per_page => 0);

ORDS.define_template(
  p_module_name    => 'postsales',
  p_pattern        => 'sales/');

ORDS.define_handler(
  p_module_name    => 'postsales',
  p_pattern        => 'sales/',
  p_method         => 'POST',
  p_source_type    => ORDS.source_type_plsql,
  p_source         => '
BEGIN
create_sales (
  P_PROD_ID => :prodid,
  P_CUST_ID => :custid,
  P_TIME_ID => :timeid,
  P_CHANNEL_ID => :channelid,
  P_PROMO_ID => :promoid,
  P_QUANTITY SOLD => :qtysold,
  P_SELLER => :seller,
  P_FULFILLMENT_CENTER => :fullcenter,
  P_COURIER_ORG => :courierorg,
  P_TAX_COUNTRY => :taxcountry,
  P_TAX_REGION => :taxregion,
  P_AMOUNT_SOLD => :amountsold);
END;',
  p_items_per_page => 0);
commit;
END;
/
```

### Hay que utilizar un JSON para el paso de parametros:

```
[opc@clicn01 ~]$ cat cre.sales.json
{
  "prodid": "132",
  "custid": "1684090",
  "timeid": "2018-03-28 00:00:00",
  "channelid": "9",
  "promoid": "419",
  "qtysold": "34",
  "seller": "10180",
  "fullcenter": "13681",
  "courierorg": "1105",
  "taxcountry": "NT",
  "taxregion": "KM",
  "amountsold": "1000"
}
```

```
curl -i -X POST --data-binary @/home/opc/cre.sales.json -H "Content-Type: application/json" http://172.16.1.4:8080/ords/jsonpdb/sh/cresale/sales/
```

# ORDS



# Create USER for ORDS

```
create user ords02 identified by oracle default tablespace users temporary tablespace temp;
```

```
grant create session to ords02;
```

```
grant create table to ords02;
```

```
grant unlimited tablespace to ords02;
```

# ORDS Install & Execute

```
java -jar ords.war install advanced
```

```
java -jar ords.war -help
```

```
nohup java -jar ords.war standalone &
```

### Oracle SQL Developer

The Oracle SQL Developer interface shows a "New / Select Database Connection" dialog box in the foreground. The dialog contains fields for Name (set to "tefdb\_pdb1\_sh"), Database Type (set to "Oracle"), User Info (Proxy User), Authentication Type (Default), Username (sh), Role (default), Password (\*\*\*\*), and Connection Type (Basic). The Hostname is set to "10.0.0.4", Port to "1521", and Service name to "pdb01.sub07030810200.vcn01.oraclevcn.com". The "Save Password" checkbox is checked. Below the dialog, the status bar displays "Status :". At the bottom of the screen, a message bar says "Click on an identifier with the Control key down to perform "Go to Declaration"".

**Connections**

- + Oracle Connections
- + tefdb\_pdb1\_ords01
- + tefdb\_pdb1\_ords02
- + tefdb\_pdb1\_sh
- Tables (Filtered)
  - + CAL\_MONTH\_SALES\_MV
  - + CHANNELS
  - + COSTS
  - + COUNTRIES
  - + CUSTOMERS
  - + DR\$UP\_TEXT\_IDX\$I
  - + DR\$UP\_TEXT\_IDX\$K
  - + DR\$UP\_TEXT\_IDX\$N
  - + DR\$UP\_TEXT\_IDX\$R
  - + DR\$UP\_TEXT\_IDX\$U
  - + FWEEK\_PSCAT\_SALES\_MV
  - + PRODUCTS
  - + PROMOTIONS
  - + SALES
  - + SALES\_TRANSACTIONS\_EXT
  - + SUPPLEMENTARY\_DEMOGRAPHICS
  - + TIMEC

**REST Development**

**REST Data Services**

- + Modules
- + Privileges

**New / Select Database Connection**

Connection Name: tefdb\_pdb1\_sh

Database Type: Oracle

User Info: Proxy User

Authentication Type: Default

Username: sh

Role: default

Password: \*\*\*\*

Save Password:

Connection Type: Basic

Hostname: 10.0.0.4

Port: 1521

SID

Service name: pdb01.sub07030810200.vcn01.oraclevcn.com

Status :

Help Save Clear Test Connect Cancel

Messages - Log

Messages | Statements | Logging Page

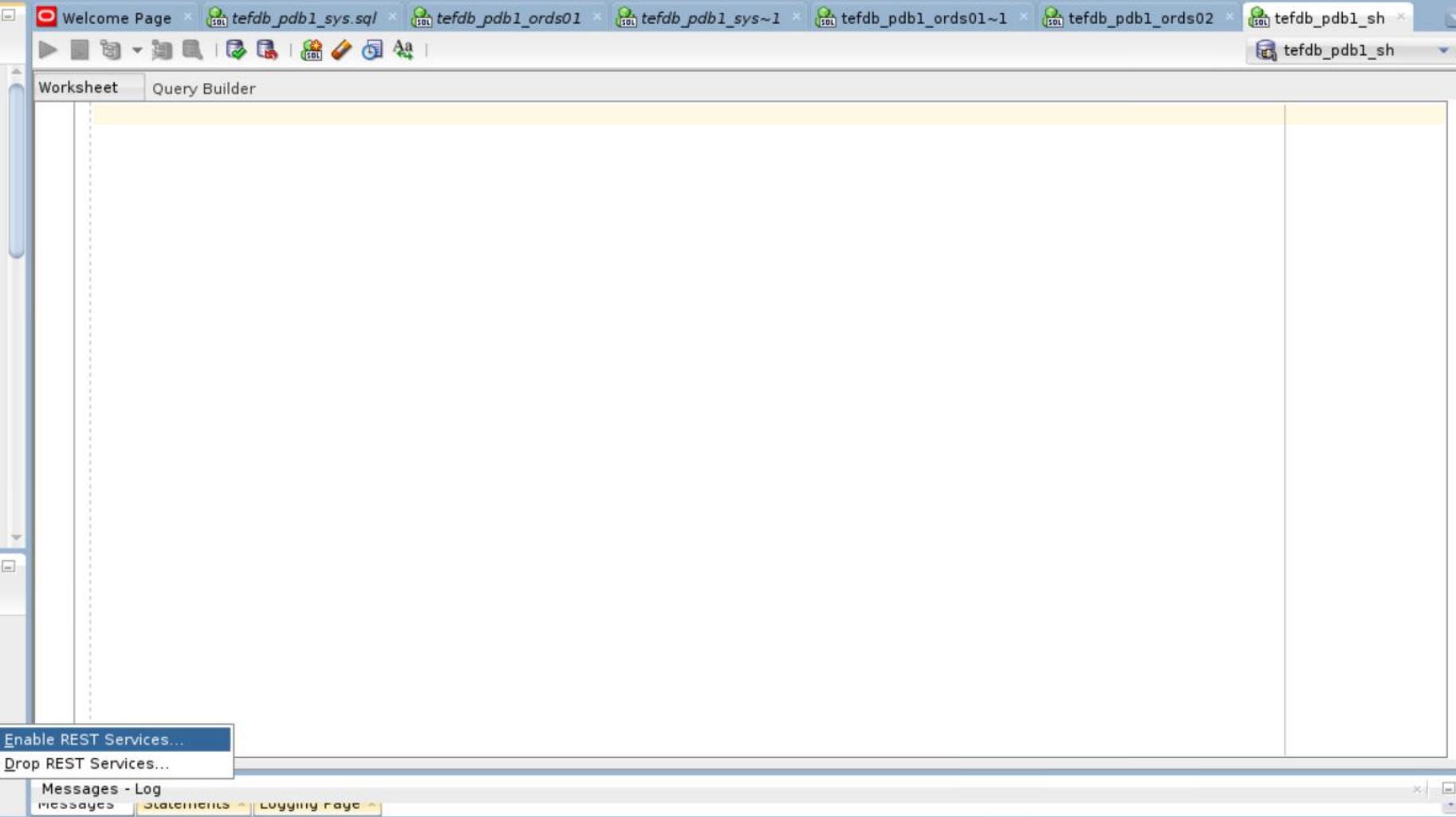
Click on an identifier with the Control key down to perform "Go to Declaration"

Oracle SQL Develop

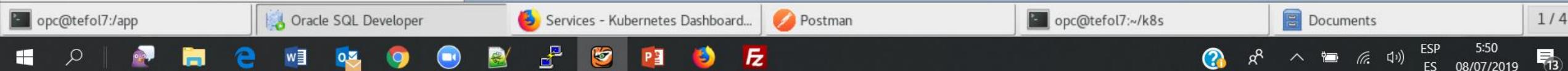
File Edit View Navigate Run Team Tools Window Help



- The screenshot shows the Oracle SQL Developer interface. The left sidebar has a tree view under 'Connections' with nodes for 'Oracle Connections' (selected), 'terdb\_pdb1\_ords01', 'terdb\_pdb1\_ords02', and 'terdb\_pdb1\_sh'. A context menu is open over the 'terdb\_pdb1\_sh' node, listing options: Connect, Disconnect, Reconnect, Reset Password..., Schema Browser, Find DB Object, Rename Connection..., Delete, Add to Folder, Remove from Folder, Apply Filter..., Clear Filter, Debug..., Manage Database, Migration Repository, and Manage Features. Below the connections, there's a 'REST Development' section with 'REST Data Server' (selected), 'Modules' (disabled), and 'Privileges' (disabled). At the bottom, there are tabs for 'REST Services' (selected) and 'Properties'.



Click on an identifier with the Control key down to perform "Go to Declaration".



Oracle SQL Developer

File Edit View Navigate Run Team Tools Window Help

Connections

- + Oracle Connections
- + tefdb\_pdb1\_ords01
- + tefdb\_pdb1\_ords02
- + tefdb\_pdb1\_sh
  - Tables (Filtered)
    - + CAL\_MONTH\_SALES\_MV
    - + CHANNELS
    - + COSTS
    - + COUNTRIES
    - + CUSTOMERS
    - + DR\$UP\_TEXT\_IDX\$I
    - + DR\$UP\_TEXT\_IDX\$K
    - + DR\$UP\_TEXT\_IDX\$N
    - + DR\$UP\_TEXT\_IDX\$R
    - + DR\$UP\_TEXT\_IDX\$U
    - + FWEEK\_PSCAT\_SALES\_MV
    - + PRODUCTS
    - + PROMOTIONS
    - + SALES
    - + SALES\_TRANSACTIONS\_EXT
    - + SUPPLEMENTARY\_DEMOGRAPHICS
    - + TIMEC

REST Development

REST Data Services

- + Modules
- + Privileges

RESTful Services Wizard - Step 1 of 2

Specify Details

RESTful Summary

Enable schema

Schema alias sh

Authorization required

Help < Back Next > Finish Cancel

Messages - Log

Click on an identifier with the Control key down to perform "Go to Declaration"

Oracle SQL Developer

File Edit View Navigate Run Team Tools Window Help

Connections

- + Oracle Connections
- tefdb\_pdb1\_ords01
- tefdb\_pdb1\_ords02
- tefdb\_pdb1\_sh
- Tables (Filtered)
  - CAL\_MONTH\_SALES\_MV
  - CHANNELS
  - COSTS
  - COUNTRIES
  - CUSTOMERS
  - DR\$UP\_TEXT\_IDX\$I
  - DR\$UP\_TEXT\_IDX\$K
  - DR\$UP\_TEXT\_IDX\$N
  - DR\$UP\_TEXT\_IDX\$R
  - DR\$UP\_TEXT\_IDX\$U
  - FWEEK\_PSCAT\_SALES\_MV
  - PRODUCTS
  - PROMOTIONS
  - SALES
  - SALES\_TRANSACTIONS\_EXT
  - SUPPLEMENTARY\_DEMOGRAPHICS
  - TIMES

REST Development

REST Data Services

- Modules
- Privileges

RESTful Services Wizard - Step 2 of 2

RESTful Summary

Specify Details RESTful Summary

Summary SQL

RESTful Services Summary

Schema RESTful Summary

- Enabled (Green checkmark)
- Alias: sh (Grey X)
- Authorization required (Red X)
- Commit (Green checkmark)

Help < Back Next > Finish Cancel

Messages - Log

Click on an identifier with the Control key down to perform "Go to Declaration"

opc@tefol7:app Oracle SQL Developer Services - Kubernetes Dashboard... Postman opc@tefol7:~/k8s Documents 1 / 4

Oracle SQL Developer

File Edit View Navigate Run Team Tools Window Help

Connections

- + Oracle Connections
- tefdb\_pdb1\_ords01
- tefdb\_pdb1\_ords02
- tefdb\_pdb1\_sh
- Tables (Filtered)
  - CAL\_MONTH\_SALES\_MV
  - CHANNELS
  - COSTS
  - COUNTRIES
  - CUSTOMERS
  - DR\$UP\_TEXT\_IDX\$I
  - DR\$UP\_TEXT\_IDX\$K
  - DR\$UP\_TEXT\_IDX\$N
  - DR\$UP\_TEXT\_IDX\$R
  - DR\$UP\_TEXT\_IDX\$U
  - FWEEK\_PSCAT\_SALES\_MV
  - PRODUCTS
  - PROMOTIONS
  - SALES
  - SALES\_TRANSACTIONS\_EXT
  - SUPPLEMENTARY\_DEMOGRAPHICS
  - TIMES

RESTful Services Wizard - Step 2 of 2

RESTful Summary

Specify Details RESTful Summary

Summary SQL

```
DECLARE
  PRAGMA AUTONOMOUS_TRANSACTION;
BEGIN

  ORDS.ENABLE_SCHEMA(p_enabled => TRUE,
                      p_schema => 'SH',
                      p_url_mapping_type => 'BASE_PATH',
                      p_url_mapping_pattern => 'sh',
                      p_auto_rest_auth => FALSE);

  commit;

END;
```

Help < Back Next > Finish Cancel

Messages - Log

Statements Logging Page

Click on an identifier with the Control key down to perform "Go to Declaration"

### Oracle SQL Developer

File Edit View Navigate Run Team Tools Window Help

Connections

- + Oracle Connections
  - tefdb\_pdb1\_ords01
  - tefdb\_pdb1\_ords02
  - tefdb\_pdb1\_sh
    - Tables (Filtered)
      - CAL\_MONTH\_SALES\_MV
      - CHANNELS
      - COSTS
      - COUNTRIES
      - CUSTOMERS
      - DR\$SUP\_TEXT\_IDX\$I
      - DR\$SUP\_TEXT\_IDX\$K
      - DR\$SUP\_TEXT\_IDX\$N
      - DR\$SUP\_TEXT\_IDX\$R
      - DR\$SUP\_TEXT\_IDX\$U
      - FWEEK\_PSCAT\_SALES\_MV
      - PRODUCTS
      - PROMOTIONS
      - SALES
      - SALES\_TRANSACTIONS\_EXT
      - SUPPLEMENTARY\_DEMOGRAPHICS
      - TIMES

REST Development

REST Data Services

- Modules
- Privileges

Worksheet Query Builder

**Successful**

Successfully processed SQL command

OK

Messages - Log

Statements Logging Page

Click on an identifier with the Control key down to perform "Go to Declaration"

### Oracle SQL Developer

The screenshot shows the Oracle SQL Developer interface. The left sidebar displays a tree view of database connections and objects. The main pane shows the structure of a table named 'CHANNELS' with six columns. A context menu is open over the 'CHANNELS' table, with the option 'Enable REST Service...' highlighted.

**Connections**

- tefdb\_pdb1\_sh
  - Tables (Filtered)
    - CAL\_MONTH\_SALES\_MV
    - CHANNELS
    - COSTS
    - COUNTI
    - CUSTOI
    - DR\$SUP
    - DR\$SUP
    - DR\$SUP
    - DR\$SUP
    - FWEEK
    - PRODUCTS
    - PROMO
    - SALES
    - SALES
    - SUPPLIERS
    - TIMES
  - Views
  - Indexes
- REST Development
- REST Data Services
  - Modules
  - Privileges

**Actions...**

COLUMN_NAME	DATA_TYPE	NULLABLE	DATA_DEFAULT	COLUMN_ID	COMMENTS
1 CHANNEL_ID	NUMBER	No	(null)	1	primary key column
2 CHANNEL_DESC	VARCHAR2(20 BYTE)	No	(null)	2	e.g. telesales, internet, catalog
3 CHANNEL_CLASS	VARCHAR2(20 BYTE)	No	(null)	3	e.g. direct, indirect
4 CHANNEL_CLASS_ID	NUMBER	No	(null)	4	(null)
5 CHANNEL_TOTAL	VARCHAR2(13 BYTE)	No	(null)	5	(null)
6 CHANNEL_TOTAL_ID	NUMBER	No	(null)	6	(null)

**Messages - Log**

Messages Statements Logging Page

Oracle SQL Developer

File Edit View Navigate Run Team Tools Window Help

Connections tefdb\_pdb1\_sh ...ql tefdb\_pdb1\_ords01 tefdb\_pdb1\_sys~1 tefdb\_pdb1\_ords01~1 tefdb\_pdb1\_ords02 tefdb\_pdb1\_sh CHANNELS Indexes SQL

RESTful Services Wizard - Step 1 of 2

Specify Details

RESTful Summary

Enable object  Object alias channels Authorization required

Help < Back Next > Finish Cancel

Messages - Log

opc@tefol7:app Oracle SQL Developer Services - Kubernetes Dashboard... Postman opc@tefol7:~/k8s Documents 1 / 4

This screenshot shows the Oracle SQL Developer interface with the RESTful Services Wizard open. The 'Connections' sidebar on the left lists several databases, with 'tefdb\_pdb1\_sh' selected. The main workspace displays the 'Specify Details' step of the wizard, which allows defining an object alias ('channels') for the selected database connection. Other tabs like 'RESTful Summary' and 'Help' are also visible. The bottom navigation bar includes links to the Oracle SQL Developer home, Kubernetes dashboard, Postman, and local terminal sessions.

Oracle SQL Developer

File Edit View Navigate Run Team Tools Window Help

Connections tefdb\_pdb1\_sh ...ql tefdb\_pdb1\_ords01 tefdb\_pdb1\_sys~1 tefdb\_pdb1\_ords01~1 tefdb\_pdb1\_ords02 tefdb\_pdb1\_sh CHANNELS Indexes SQL

RESTful Services Wizard - Step 2 of 2

RESTful Summary

Specify Details RESTful Summary

Summary SQL

RESTful Services Summary Object RESTful Summary

- Enabled (Green checkmark)
- Alias: channels (Red X)
- Authorization required (Red X)
- Commit (Green checkmark)

Help < Back Next > Finish Cancel

Messages - Log

opc@tefol7:app Oracle SQL Developer Services - Kubernetes Dashboard... Postman opc@tefol7:~/k8s Documents 1 / 4

This screenshot shows the Oracle SQL Developer interface with the RESTful Services Wizard open. The main window displays the 'RESTful Summary' step, which includes sections for 'Specify Details' and 'RESTful Summary'. Under 'RESTful Summary', there are tabs for 'Summary' and 'SQL'. The 'Summary' tab shows a tree structure for 'RESTful Services Summary' and 'Object RESTful Summary', with several configuration items listed. One item, 'Alias: channels', is marked with a red X, indicating it is not enabled. Other items like 'Enabled', 'Commit', and 'Authorization required' have green checkmarks. Below the wizard are standard navigation buttons: Help, Back, Next, Finish, and Cancel. At the bottom, there's a 'Messages - Log' panel showing tabs for 'Messages', 'Statements', and 'Logging page'. The left sidebar contains a 'Connections' tree view for the 'tefdb\_pdb1\_sh' database, showing tables like 'CAL\_MONTH\_SALES\_MV', 'CHANNELS', 'COSTS', 'COUNTRIES', 'CUSTOMERS', and various DR\$ indexes. Below this are 'Views', 'Indexes', and 'Private synonyms'. A 'REST Development' section is also present. The bottom taskbar shows icons for the terminal ('opc@tefol7:app'), browser ('Oracle SQL Developer'), services ('Services - Kubernetes Dashboard...'), and other tools ('Postman', 'opc@tefol7:~/k8s', 'Documents'). The status bar at the bottom right indicates the date and time as '08/07/2019 5:54'.

Oracle SQL Developer

File Edit View Navigate Run Team Tools Window Help

Connections tefdb\_pdb1\_sh ...ql tefdb\_pdb1\_ords01 tefdb\_pdb1\_sys~1 tefdb\_pdb1\_ords01~1 tefdb\_pdb1\_ords02 tefdb\_pdb1\_sh CHANNELS

RESTful Services Wizard - Step 2 of 2

RESTful Summary

Specify Details RESTful Summary

Summary SQL

```
DECLARE
  PRAGMA AUTONOMOUS_TRANSACTION;
BEGIN
  ORDS.ENABLE_OBJECT(p_enabled => TRUE,
    p_schema => 'SH',
    p_object => 'CHANNELS',
    p_object_type => 'TABLE',
    p_object_alias => 'channels',
    p_auto_rest_auth => FALSE);
  commit;
END;
```

Indexes SQL

lumn  
, internet, catalog  
ndirect

Help < Back Next > Finish Cancel

Messages - Log

opc@tefol7:app Oracle SQL Developer Services - Kubernetes Dashboard... Postman opc@tefol7:~/k8s Documents 1 / 4

Mozilla Firefox

Developing Oracle REST API | 10.0.0.3:8080/ords/sh/chapter | 10.0.0.3:8080/ords/ords | Services - Kubernetes Dashboard | 130.61.13.76:8080/ords/clickhouse | +

① [10.0.0.3:8080/ords/sh/channel](http://10.0.0.3:8080/ords/sh/channel)

 Filter JSON

Save Copy

▼ items:

```
0:  
    channel_id:      3  
    channel_desc:   "Direct Sales"  
    channel_class:  "Direct"  
    channel_class_id: 12  
    channel_total:  "Channel tota  
    channel_total_id: 1
```

<http://10.0.0.3:8080/ords/sh/channels/>

```
    "links": [ {  
        "rel": "self",  
        "href": "http://10.0.0.3:8080/ords/sh/channel/  
    } ]  
}
```

```
1:  
  channel_id:      9  
  channel_desc:   "Tele Sales"  
  channel_class:  "Direct"  
  channel_class_id: 12  
  channel_total:  "Channel total"  
  channel_total_id: 1
```

```
    ▼ links:
      ▼ 0:
        rel:          "self"
        href:         "http://10.0.0.3:8080/ords/sh/channels"
```

```
2:  
  channel_id:      5  
  channel_desc:   "Catalog"  
  channel_class:  "Indirect"  
  channel_class_id: 13  
  channel_total:  "Channel total"  
  channel_total_id: 1
```

opc@tefol7:/app

Oracle SQL Develop

Mozilla Firef

 Postman

- opc@tefol7:~/k8s

## Documents

# Postman

File Edit View Help

New Import Runner + My Workspace Invite No Environment Sign In

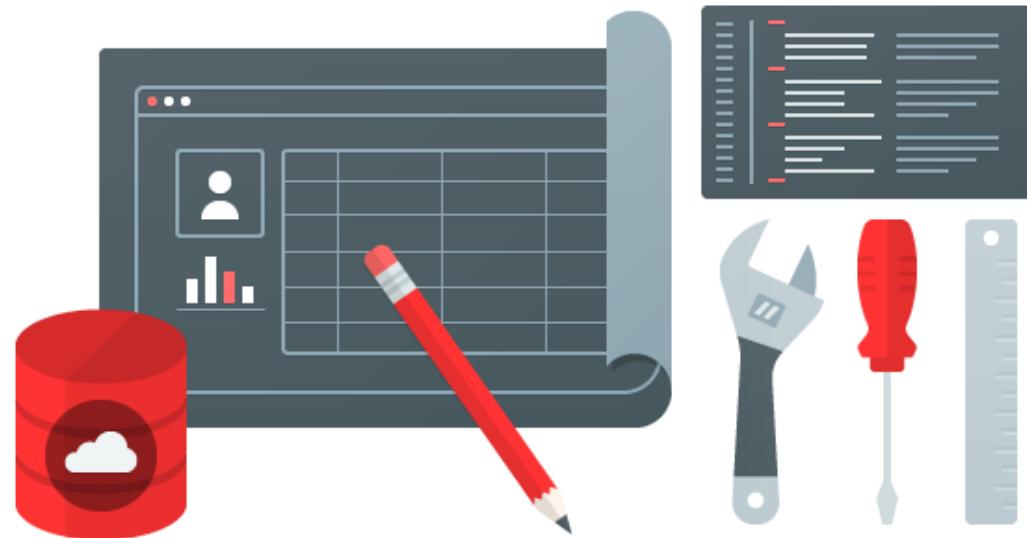
Filter History Collections APIs BETA + New Collection Trash

GET http://10.0.0.3:8080/ords/sh/channels/ Send Save

Pretty Raw Preview JSON

```
57      ],
58  },
59  {
60    "channel_id": 2,
61    "channel_desc": "Partners",
62    "channel_class": "Others",
63    "channel_class_id": 14,
64    "channel_total": "Channel total",
65    "channel_total_id": 1,
66    "links": [
67      {
68        "rel": "self",
69        "href": "http://10.0.0.3:8080/ords/sh/channels/2"
70      }
71    ],
72  },
73  {
74    "channel_id": 11,
75    "channel_desc": "Test Oli 2",
76    "channel_class": "Direct",
77    "channel_class_id": 12,
78    "channel_total": "Channel total",
79    "channel_total_id": 1,
80    "links": [
81      {
82        "rel": "self",
83        "href": "http://10.0.0.3:8080/ords/sh/channels/11"
84      }
85    ]
}
```

# ORDS with Security Access





File Edit View Navigate Run Source Team Tools Window Help



## Connections

- + Procedures
- + Functions
- + Operators
- + Queues
- + Queues Tables
- + Triggers
- + Types
- + Sequences
- REST Data Services
  - Modules
    - module1
    - + mytablecount/
  - Privileges
    - oracle.dbtools.autorest.privilege.ORDS01
    - oracle.dbtools.autorest.privilege.ORDS01.MYTABLE
    - oracle.soda.privilege.developer
  - Roles
    - oracle.dbtools.role.autorest.ORDS01
    - oracle.dbtools.role.autorest.ORDS01.MYTABLE
- + Materialized Views
- + Materialized View Logs

## REST Development

- REST Data Services
  - Modules
  - Privileges

Oracle SQL Developer : /home/opc/Documents/tefdb\_pdb1\_sys.sql

```
select limit from dba_profiles where profile = 'DEFAULT' and resource_name = 'PASSWORD_VERIFY_FUNCTION';
-- ORA12C_STRONG_VERIFY_FUNCTION
alter profile default limit password_verify_function null;

create user ords01 identified by oracle default tablespace users temporary tablespace temp;

grant create session to ords01;
grant create table to ords01;
grant unlimited tablespace to ords01;
```

Script Output x Query Result x  
Task completed in 0.024 seconds

User ORDS01 created.

Grant succeeded.

Grant succeeded.

Grant succeeded.

Messages - Log

Messages Statements Logging Pages

| Line 9 Column 38 | Insert | Unix/Mac: LF

File Edit View Navigate Run Source Team Tools Window Help



## Connections

- + Oracle Connections
  - tefdb\_pdb1\_ords01
    - + Tables (Filtered)
    - + Views
    - + Indexes
    - + Packages
    - + Procedures
    - + Functions
    - + Operators
    - + Queues
    - + Queues Tables
    - + Triggers
    - + Types
    - + Sequences
  - + REST Data Services
    - + Modules
      - REST module1
        - + mytablecount/
    - + Privileges
      - oracle.dbtools.autorest.privilege.ORDS01
      - oracle.dbtools.autorest.privilege.ORDS01.MYTABLE

## REST Development

- + REST Data Services
  - + Modules
  - + Privileges

## Oracle SQL Developer : tefdb\_pdb1\_ords01

```
begin
    oauth.create_client(
        p_name => 'Client Credentials Ords01',
        p_grant_type => 'client_credentials',
        p_privilege_names => 'oracle.dbtools.autorest.privilege.ORDS01.MYTABLE',
        p_support_email => 'support@example.com');
    commit;
end;

select client_id,client_secret from user_ords_clients where name = 'Client Credentials Ords01';

begin
    oauth.grant_client_role(
        'Client Credentials Ords01',
        'oracle.dbtools.role.autorest.ORDS01.MYTABLE');
    commit;
end;
```

Script Output x | Query Result x

Task completed in 0.053 seconds

PL/SQL procedure successfully completed.

Messages - Log

Messages | Statements | Logging Page

| Line 23 Column 1 | Insert | Modified | Unix/Mac LF

### Oracle SQL Developer : tefdb\_pdb1\_ords01

File Edit View Navigate Run Source Team Tools Window Help

Connections

- + Oracle Connections
- tefdb\_pdb1\_ords01
  - + Tables (Filtered)
  - + Views
  - + Indexes
  - + Packages
  - + Procedures
  - + Functions
  - + Operators
  - + Queues
  - + Queues Tables
  - + Triggers
  - + Types
  - + Sequences
- + REST Data Services
  - + Modules
    - + module1
      - + mytablecount/
  - + Privileges
    - + oracle.dbtools.autorest.privilege.ORDS01
    - + oracle.dbtools.autorest.privilege.ORDS01.MYTABLE

```
oAuth.grant_client_role(
    'Client Credentials Ords01',
    'oracle.dbtools.role.autorest.ORDS01.MYTABLE');
commit;
end;

BEGIN
    ORDS.define_service(
        p_module_name      => 'module1',
        p_base_path        => 'mod1/',
        p_pattern          => 'mytablecount/',
        p_method           => 'GET',
        p_source_type      => ORDS.source_type_collection_feed,
        p_source            => 'SELECT count(*) FROM mytable',
        p_items_per_page   => 0);

    COMMIT;
END;
/
```

Script Output x Query Result x  
Task completed in 0.053 seconds

PL/SQL procedure successfully completed.

Messages - Log  
Messages | Statements | Logging Page

| Line 23 Column 1 | Insert | Modified | Unix/Mac LF

Mozilla Firefox

Developing Oracle REST | 10.0.0.3:8080/ords/ords0 | Services - Kubernetes Da | 130.61.13.76:8080/ords/c | +

10.0.0.3:8080/ords/ords01/mod1/mytablecount/

JSON Raw Data Headers

Save Copy Filter JSON

```
items:
  0:
    count(*): 3
    hasMore: false
    limit: 0
    offset: 0
    count: 1
  links:
    0:
      rel: "self"
      href: "http://10.0.0.3:8080/ords/ords01/mod1/mytablecount/"
    1:
      rel: "describedby"
      href: "http://10.0.0.3:8080/ords/ords01/metadata-catalog/mod1/mytablecount/"
```

tefol7:1 (opc) - TigerVNC

Applications Places Postman

en Mon 00:42

Postman

File Edit View Help

New Import Runner + My Workspace Invite No Environment

Filter History Collections APIs BETA + New Collection Trash

ORDS 6 requests

- POST Get OAuth token
- GET Get data from table using token
- GET Get data from table using token 2
- POST Insert data to table using token
- PUT Update data to table using token
- DEL Delete data to table using token

ORDS k8s 7 requests

- POST Get OAuth token
- GET Get data from table using token
- GET Get data from table using token 2
- POST Insert data to table using token
- PUT Update data to table using token
- DEL Delete data to table using token

TYPE Bearer Token

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment, we recommend using variables. [Learn more about variables](#)

Token j55rw9p\_xkyNLpznwRyYvA

Preview Request

Status: 200 OK Time: 63 ms Size: 897 B

Body Cookies Headers (4) Test Results

Pretty Raw Preview JSON

```
1 {  
2   "items": [  
3     {  
4       "id": 1,  
5       "text": "texto uno",  
6       "links": [  
7         {  
8           "rel": "self",  
9           "href": "http://10.0.0.3:8080/ords/ords01/mytable/1"  
10      ]  
11    ]  
12  }  
13 }
```

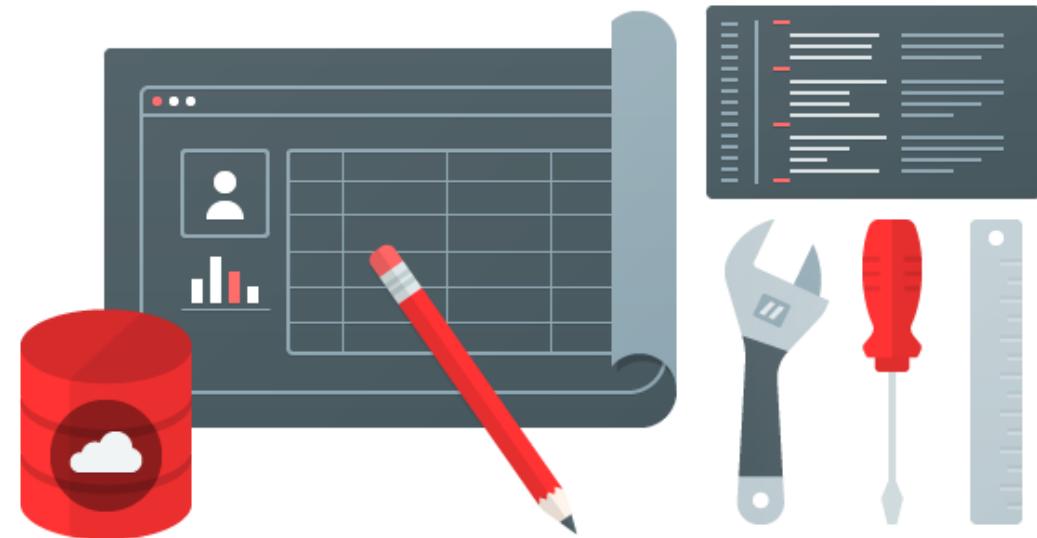
Bootcamp

opc@tefol7:app Oracle SQL Developer Services - Kubernetes Dashboard... Postman [opc@tefol7:~/k8s] Documents 1 / 4

Windows Search File Explorer Mail Edge Microsoft Store Camera Paint 3D Modeler Powerpoint Firefox

ESP ES 2:42 08/07/2019 13

# Kubernetes K8S



# Kubernetes

Kubernetes provides abstractions for deploying software in containers at scale

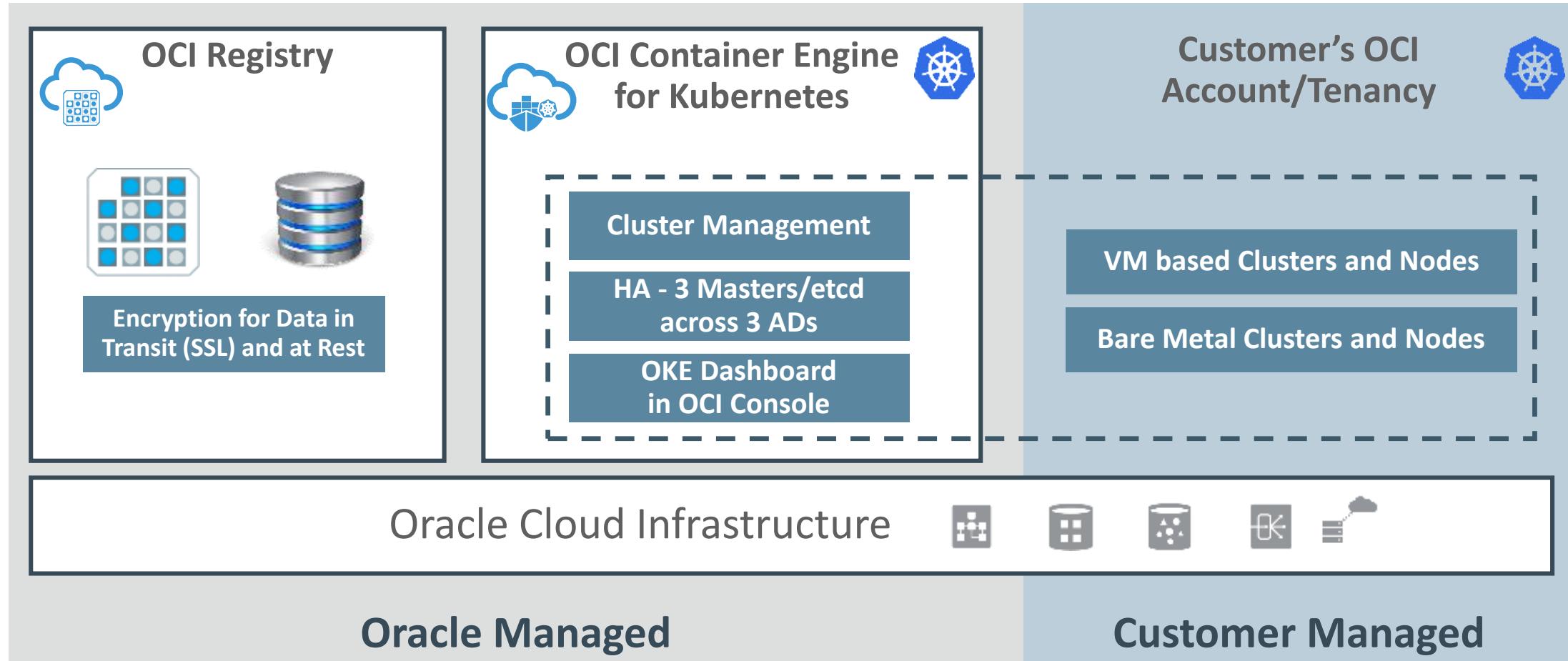
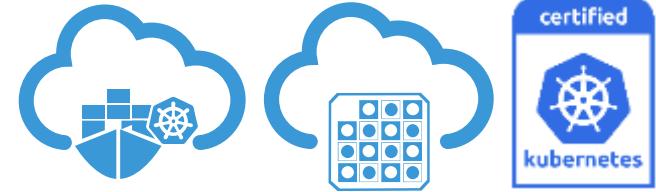


# Kubernetes as a Platform

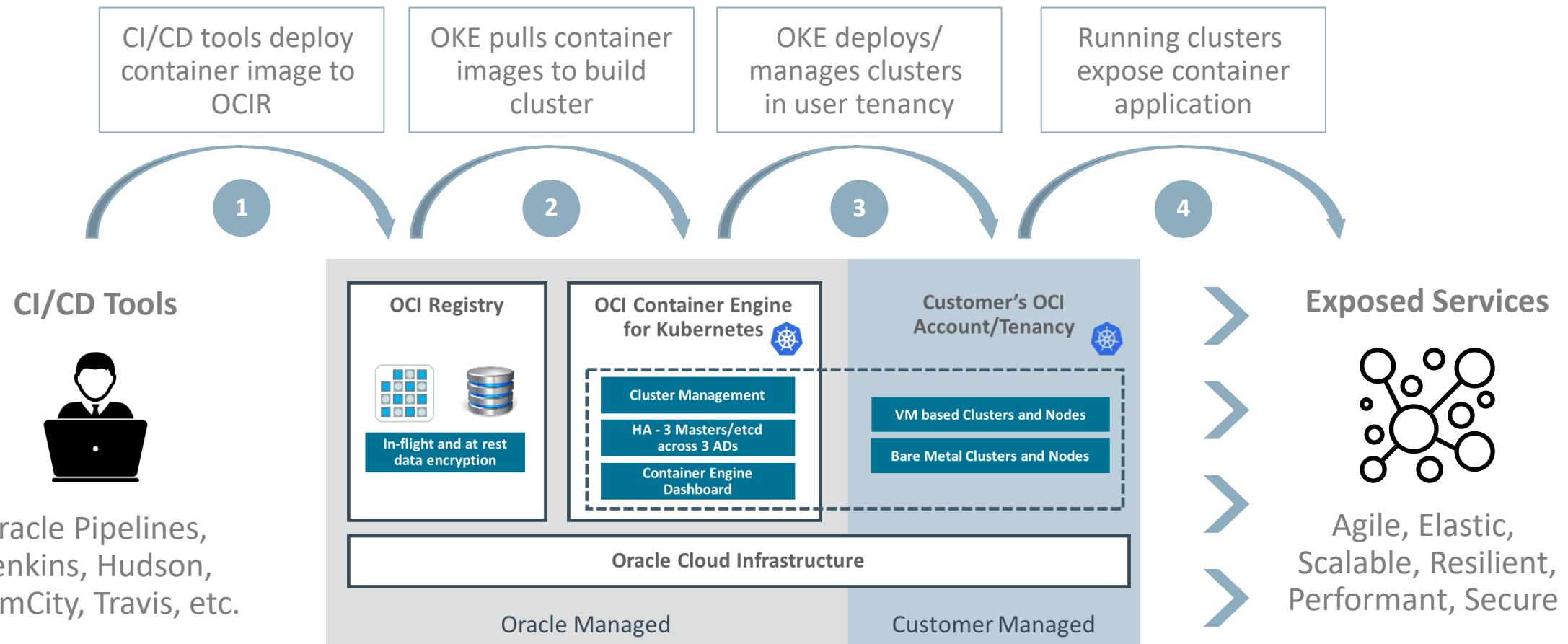
- Infrastructure resource abstraction
- Cluster software where one or more masters control worker nodes
- Scheduler deploys work to the nodes
- Work is deployed in groups of containers



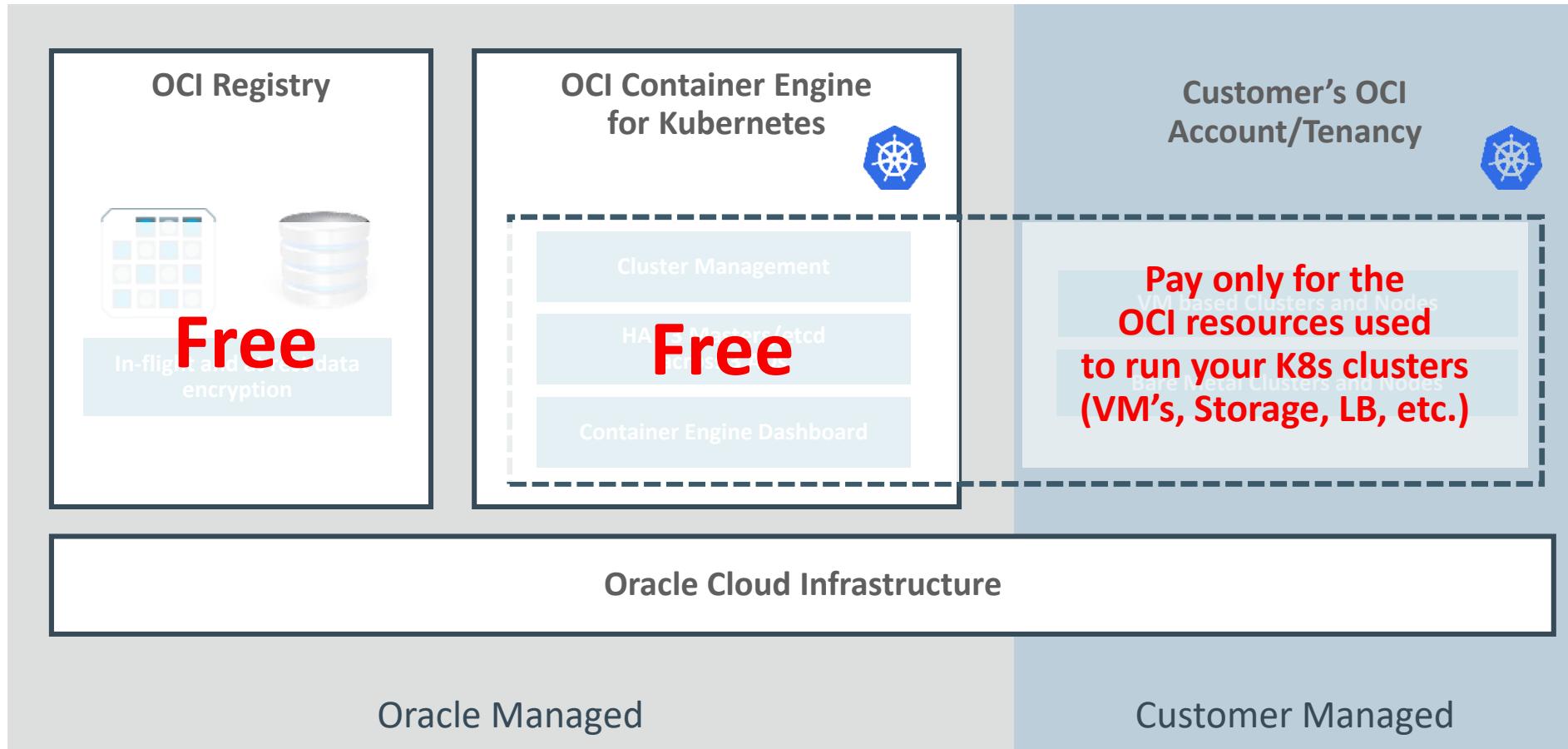
# Working with OKE and OCIR on OCI



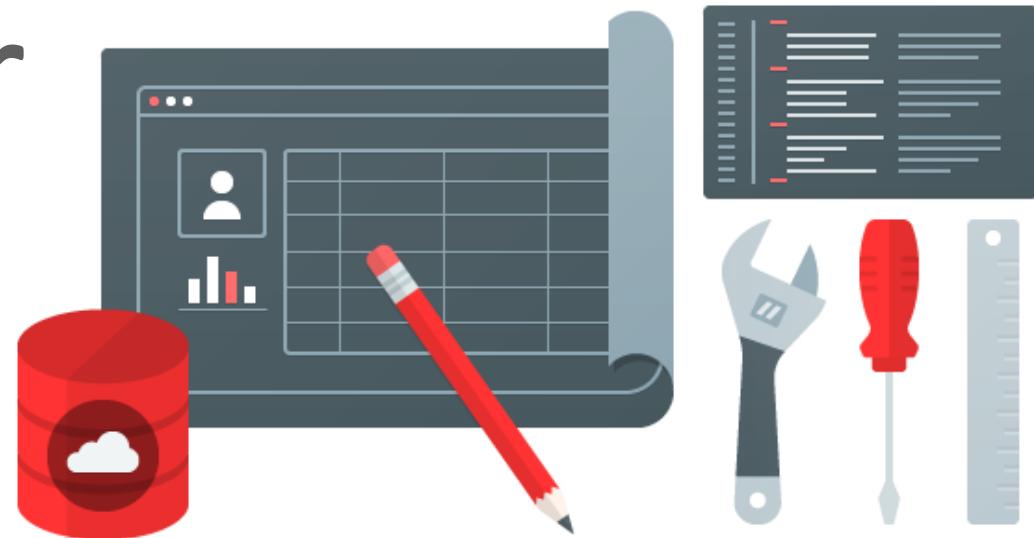
# Container Application Life Cycle



# OKE/OCIR Pricing and Packaging



# ORDS in Docker & K8S



The screenshot shows the Docker Hub interface for the repository 'tallerords/ords'. The top navigation bar includes links for Explore, Repositories, Organizations, Get Help, and a user account for tallerords. The main header displays the repository name 'tallerords / ords' and a message indicating 0 private repositories available. Below the header, a navigation menu offers tabs for General, Tags, Builds, Timeline, Permissions, Webhooks, and Settings. The 'General' tab is currently selected. The main content area features a large card for the repository 'tallerords / ords'. It includes a description placeholder ('This repository does not have a description'), a last pushed timestamp ('Last pushed: never'), and a 'Docker commands' section with a 'Public View' button and a command-line example: 'docker push tallerords/ords:tagname'. A second card below is titled 'Tags' and notes that the repository is currently empty. A third card at the bottom is titled 'Full Description' and also indicates the description is empty.

tallerords / ords

Using 0 of 0 private repositories. [Get more](#)

General Tags Builds Timeline Permissions Webhooks Settings

**tallerords / ords**

This repository does not have a description

Last pushed: never

Docker commands

To push a new tag to this repository,

`docker push tallerords/ords:tagname`

Public View

Tags

This repository is empty. When it's not empty, you'll see a list of the most recent tags here.

Full Description

Repository description is empty. Click [here](#) to edit.

tefol7:1 (opc) - TigerVNC

Applications Places Firefox

Services - Kubernetes Dashboard - Mozilla Firefox

Developing Oracle REST | 10.0.0.3:8080/ords/ords0 | Services - Kubernetes Da | 130.61.13.76:8080/ords/c | +

localhost:8001/api/v1/namespaces/kube-system/services/https:kubernetes-dashboard:/proxy/#/service?namespace=default

kubernetes

Search

+ CREATE |

Discovery and load balancing > Services

default

Overview

Workloads

Cron Jobs

Daemon Sets

Deployments

Jobs

Pods

Replica Sets

Replication Controllers

Stateful Sets

Discovery and Load Balancing

Ingresses

Services

Config and Storage

Services

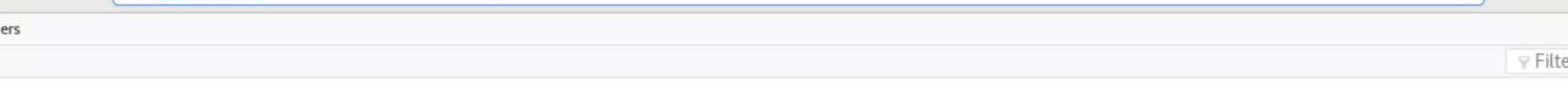
Name	Labels	Cluster IP	Internal endpoints	External endpoints	Age
ords-k8s-service	-	10.96.66.192	ords-k8s-service:8080 TCP ords-k8s-service:30486 TCP	130.61.13.76:8080	-
kubernetes	component: apiserver provider: kubernetes	10.96.0.1	kubernetes:443 TCP	-	4 minutes

opc@tefol7:app Oracle SQL Developer : tef... Services - Kubernetes Das... kubernetes\_dashboard.txt ... Postman [opc@tefol7:~/k8s] Documents

1 / 4

Windows Taskbar icons: Search, File Explorer, Edge, Mail, Chrome, Camera, Paint, File Manager, Microsoft Word, Microsoft Excel, Microsoft Powerpoint.

Mozilla Firefox



The screenshot shows a browser window with four tabs open:

- Developing Oracle REST
- 10.0.0.3:8080/ords/ords0
- Services - Kubernetes Da
- 130.61.13.76:8080/ords/c

The active tab is the fourth one, displaying a JSON response. The URL in the address bar is `130.61.13.76:8080/ords/ords01/mod1/mytablecount/`. The response is as follows:

```
items:
  0:
    count(*): 3
    hasMore: false
    limit: 0
    offset: 0
    count: 1
  links:
    0:
      rel: "self"
      href: "http://130.61.13.76:8080/ords/ords01/mod1/mytablecount/"
    1:
      rel: "describedby"
      href: "http://130.61.13.76:8080/ords/ords01/metadata-catalog/mod1/mytablecount/"
```

 Apps  perso  oracle  teradata  wedo-bdce  predictive\_mainten...  oac\_workshop  workshops  customers  nltk  gartner

```
{"items": [{"id": 1, "text": "texto uno", "links": [{"rel": "self", "href": "http://130.61.215.158:8080/ords/ords01/mytable/1"}]}, {"id": 2, "text": "mas texto", "links": [{"rel": "self", "href": "http://130.61.215.158:8080/ords/ords01/mytable/2"}]}, {"id": 4, "text": "texto desde Postman", "links": [{"rel": "self", "href": "http://130.61.215.158:8080/ords/ords01/mytable/4"}]}, {"hasMore": false, "limit": 25, "offset": 0, "count": 3, "links": [{"rel": "self", "href": "http://130.61.215.158:8080/ords/ords01/mytable/"}], {"rel": "edit", "href": "http://130.61.215.158:8080/ords/ords01/mytable/"}, {"rel": "describedby", "href": "http://130.61.215.158:8080/ords/ords01/metadata-catalog/mytable/"}, {"rel": "first", "href": "http://130.61.215.158:8080/ords/ords01/mytable/"}]}
```

# Postman

File Edit View Help

New Import Runner + My Workspace Invite No Environment Examples (0)

Filter History Collections APIs BETA + New Collection Trash

ORDS 6 requests

POST Get OAuth token  
GET Get data from table using token  
GET Get data from table using token 2  
POST Insert data to table using token  
PUT Update data to table using token  
DEL Delete data to table using token

ORDS k8s 7 requests

POST Get OAuth token  
GET Get data from table using token  
GET Get data from table using token 2  
POST Insert data to table using token  
PUT Update data to table using token  
DEL Delete data to table using token

Get data from table using token

GET http://130.61.13.76:8080/ords/ords01/mytable/

Send Save

Params Authorization Headers (9) Body Pre-request Script Tests Cookies Code Comments (0)

TYPE Bearer Token

The authorization header will be automatically generated when you send the request. [Learn more about authorization](#)

Token 8dVuXl5xMUZhTXJFcIxkAg

Preview Request

Body Cookies Headers (4) Test Results Status: 200 OK Time: 180 ms Size: 925 B Save Download

Pretty Raw Preview JSON

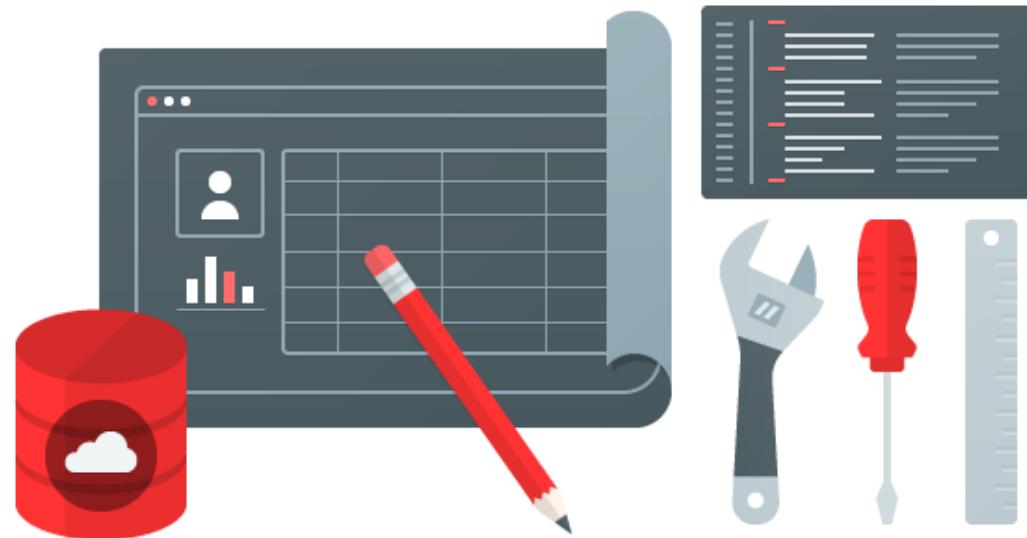
```
1 {  
2   "items": [  
3     {  
4       "id": 1,  
5       "text": "texto uno",  
6       "links": [  
7         {  
8           "url": "http://.../  
9         }  
10      ]  
11    }  
12  ]  
13}
```

Bootcamp

opc@tefol7:app Oracle SQL Developer Services - Kubernetes Dashboard... Postman [opc@tefol7:~/k8s] Documents 1 / 4

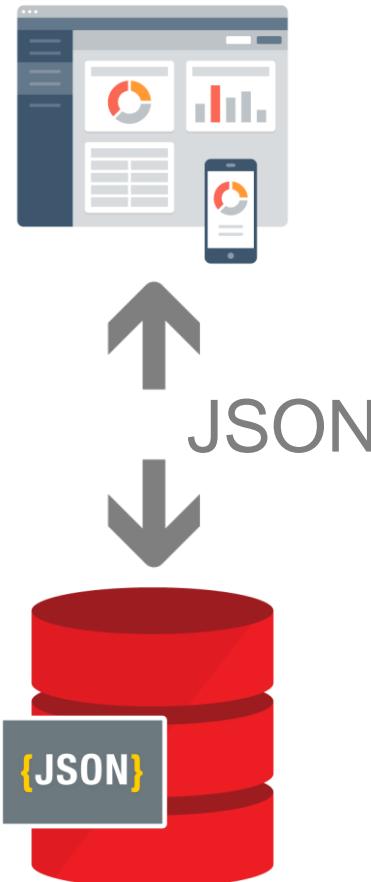
Windows Taskbar Icons: File Explorer, Edge, Mail, Camera, File Manager, Google Chrome, Microsoft Word, Microsoft Excel, Microsoft Powerpoint, Mozilla Firefox.

# ORACLE SODA SERVICES



# Oracle SODA

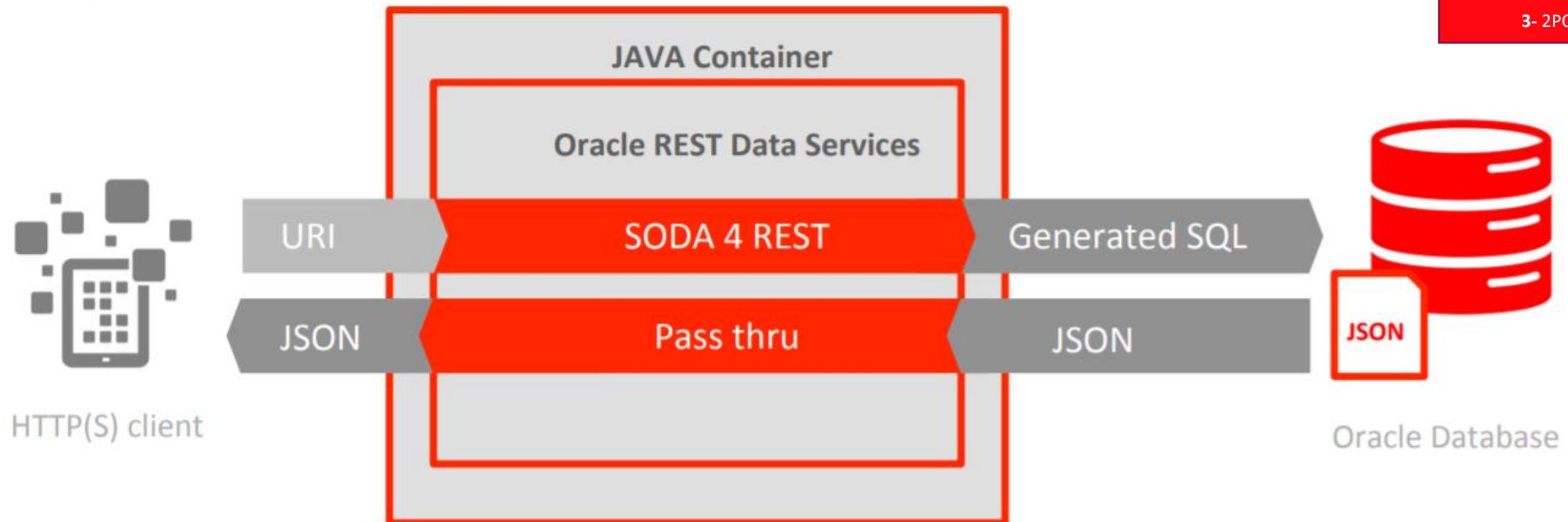
## Simple Oracle Document Access



- JSON Document APIs for REST and Java
- Leverages native 12.2 database JSON features
- Allows developers to combine the ease of use of document development and relational
- SQL analytics can be used on JSON documents
- Full PL/SQL API

# Oracle REST Data Services

## SODA for REST and ORDS 3.0



- Data stored in Oracle Database as JSON documents
- App Developer make standard HTTP(S) calls to SODA for REST API

# Oracle Database 12c as a Document Store

## 12.2 JSON DataGuide – Automatic Schema Inference

Table containing  
JSON documents

```
SQL> desc MOVIE_TICKETS
NAME                      TYPE
-----
BOOKING_ID                RAW(16)
BOOKING_TIME               TIMESTAMP(6)
BOOKING_DETAILS             VARCHAR2(4000)

{ "Theater": "AMC 15",
  "Movie": "Jurassic World 3D",
  "Time": "2015-11-26T18:45:00",
  "Tickets": {
    "Adults": 2
  }
}
```

JSON DataGuide

```
DBMS_JSON.AddVC(
  "MOVIE_TICKETS",
  "BOOKING_DETAILS");
```



Table enhanced with  
virtual columns

```
SQL> desc MOVIE_TICKETS
NAME                      TYPE
-----
BOOKING_ID                RAW(16)
BOOKING_TIME               TIMESTAMP(6)
BOOKING_DETAILS             VARCHAR2(4000)
BOOKING_DETAILS$Movie      VARCHAR2(16)
BOOKING_DETAILS$Theater    VARCHAR2(16)
BOOKING_DETAILS$Adults     NUMBER
BOOKING_DETAILS$Time       VARCHAR2(32)
```

# Oracle Database 12c as a Document Store

## 12.2 JSON DataGuide – Automatic Schema Inference

NEW IN  
12.2

The 12.2+ SQL functions available for JSON generation are:

JSON\_OBJECT – single-row function, creates an object for each row.

JSON\_ARRAY – single-row function, creates an array for each row.

JSON\_OBJECTAGG – aggregate function, creates an object based on groups of rows.

JSON\_ARRAYAGG – aggregate function, creates an array based on groups of rows.

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