

Oracle Norge/OUGN webinarer



From Edge to ML

Hands On lab on IOT/Edge computing with Arduino based sensors

11 mars, 2021

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Principal Cloud Specialist
Engineer, Oracle Norge

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Inge Os

Master Principal Cloud
Specialist, Oracle Norge

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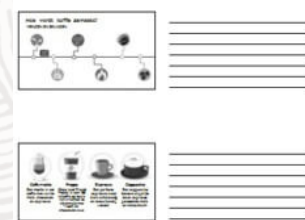
Still gjerne med Q&A knappen når som helst



Mikrofonen din
er dempet



Bruk Q&A



Slides vil bli delt

From Edge to ML



11/5-2021 Hands On lab on IOT/Edge computing with Arduino based sensors

27/5-2021 Applied Machine Learning based on sensor data, with Auto ML

10/6-2021 An intelligent app with APEX low-code, extended with Machine Learning

<https://go.oracle.com/LP=109857?elqCampaignId=294067>

Agenda



Introduction

Prepare Database, create REST API

Prepare Arduino IDE

Create Code and run

<https://github.com/bios62/meetups/tree/bios62-11-05-2021-arduino-lab>

Introduction

What we will build

Building blocks

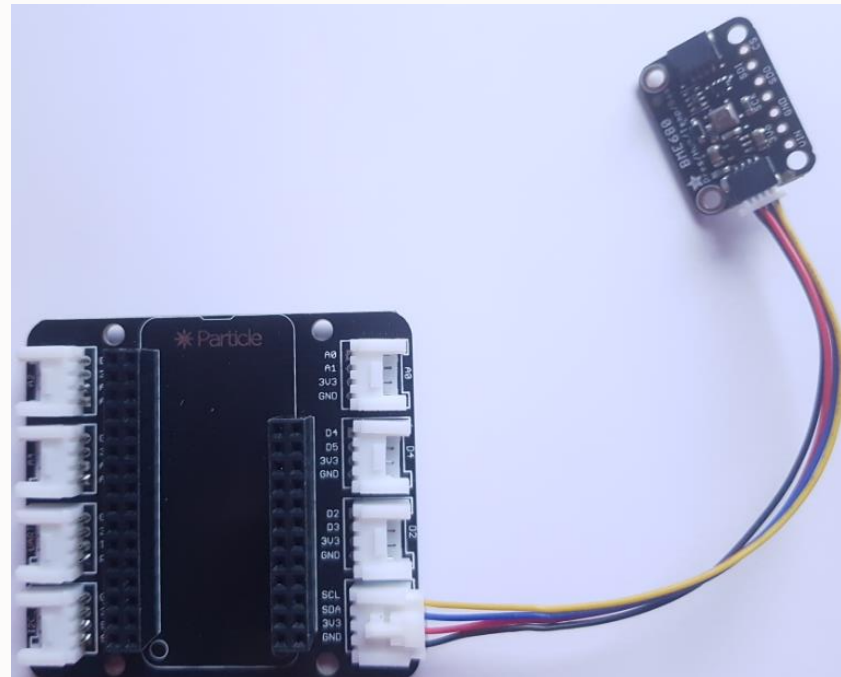
Always Free Cloud Account

Autonomous Database, ATP, with ORDS and SODA

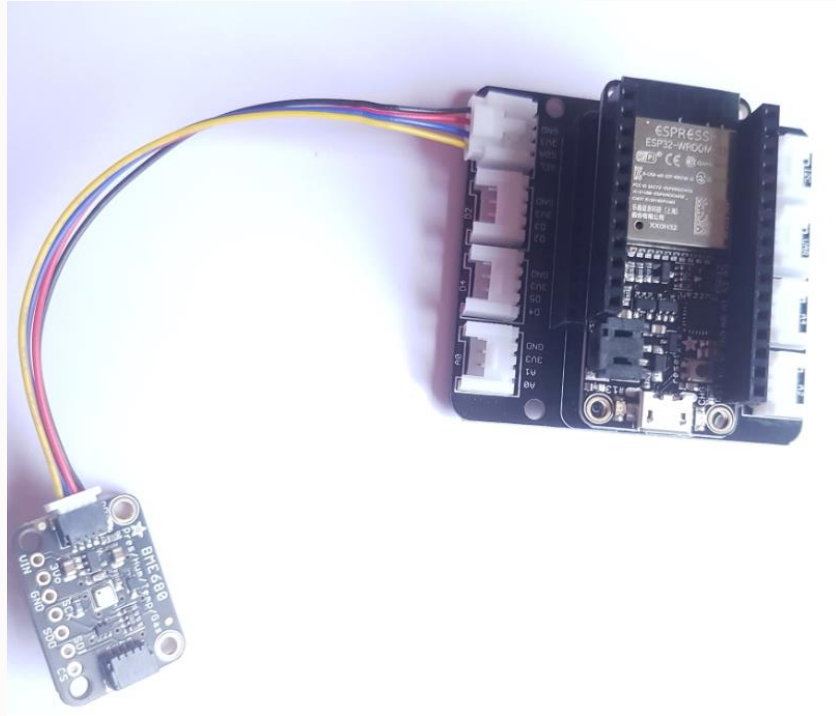
Arduino Microcontroller

Arduino IDE

Arduino and Sensors



Arduino and Sensors



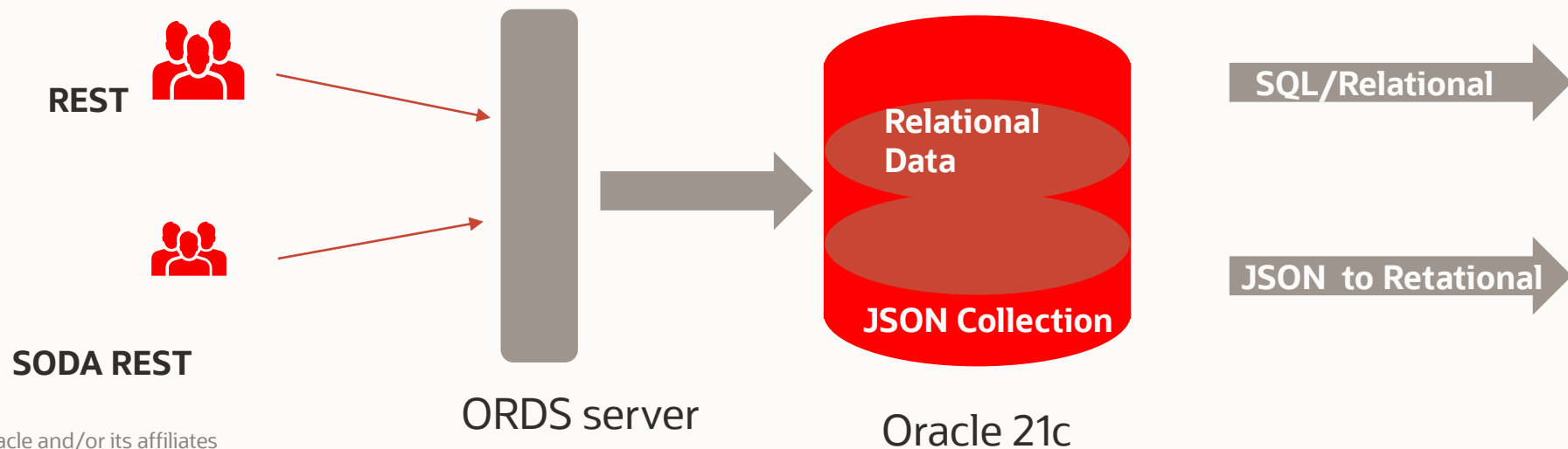
Arduino Adafruit Huzzah32 ESP32 Feather
240 MHz dual core Tensilica LX6 microcontroller
520 KB SRAM , 4MB Flash
WiFi
BME680 sensor
temperature, humidity, barometric pressure, VOC gas

JSON/REST Data access overview

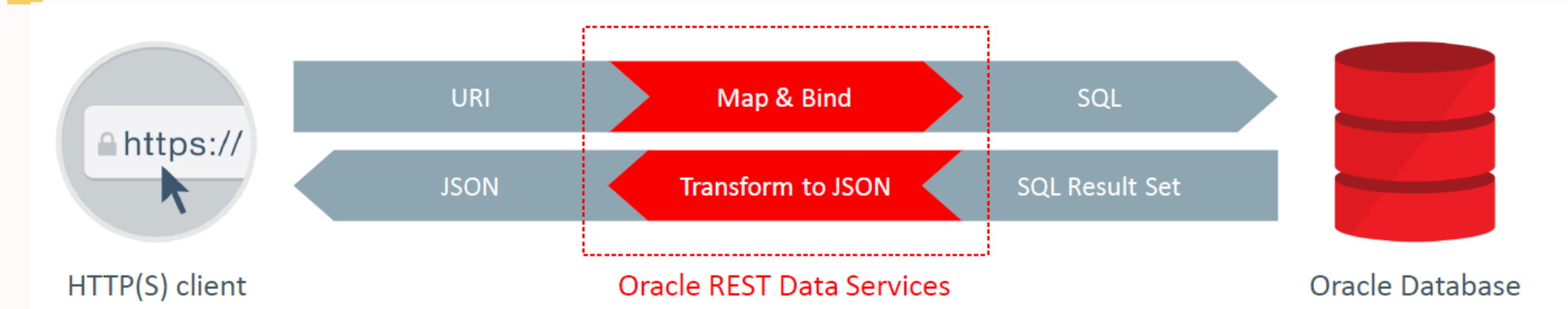
REST enable relational CRUD DML, with Oracle Rest Data Services, ORDS

NoSQL type data access with Oracle SODA

Native JSON storage in the database for fast processing CRUD



Oracle ORDS



Java J2EE mid tier application, e.g., WebLogic, Tomcat, Glassfish

- Also supports “Standalone” mode for development

For input, maps/binds URI to SQL and PL/SQL

For output, transforms results to JSON and other formats

ORDS uses declarative approach, gives the DBA full control over what is exposed and how

Oracle SODA



SODA is Oracle API for creating a OOTB JSON Document Database
SODA REST API does not yet create JSON type document store OOTB

It provides a set of APIs

REST

JAVA

PL/SQL

Node.js

Python

Uses HTTP Verbs

GET, Select

PUT create collection

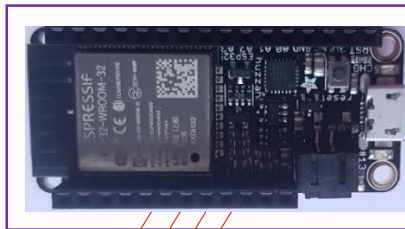
DELETE, drop collection

POST insert/update

Introduction

What we will build

Arduino



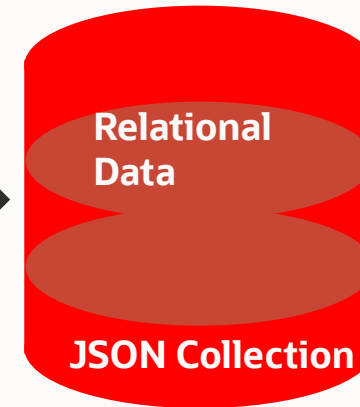
I2C Bus



BME 680



REST POST of sensor data
WiFi/HTTPS



Always Free

Server side



There are two options

- Use ORDS to create a REST API based on a standard SQL Table
- Use SODA to create a JSON document store collection

In the Lab we will share the code for both solutions

Server side preparation, Always Free Database

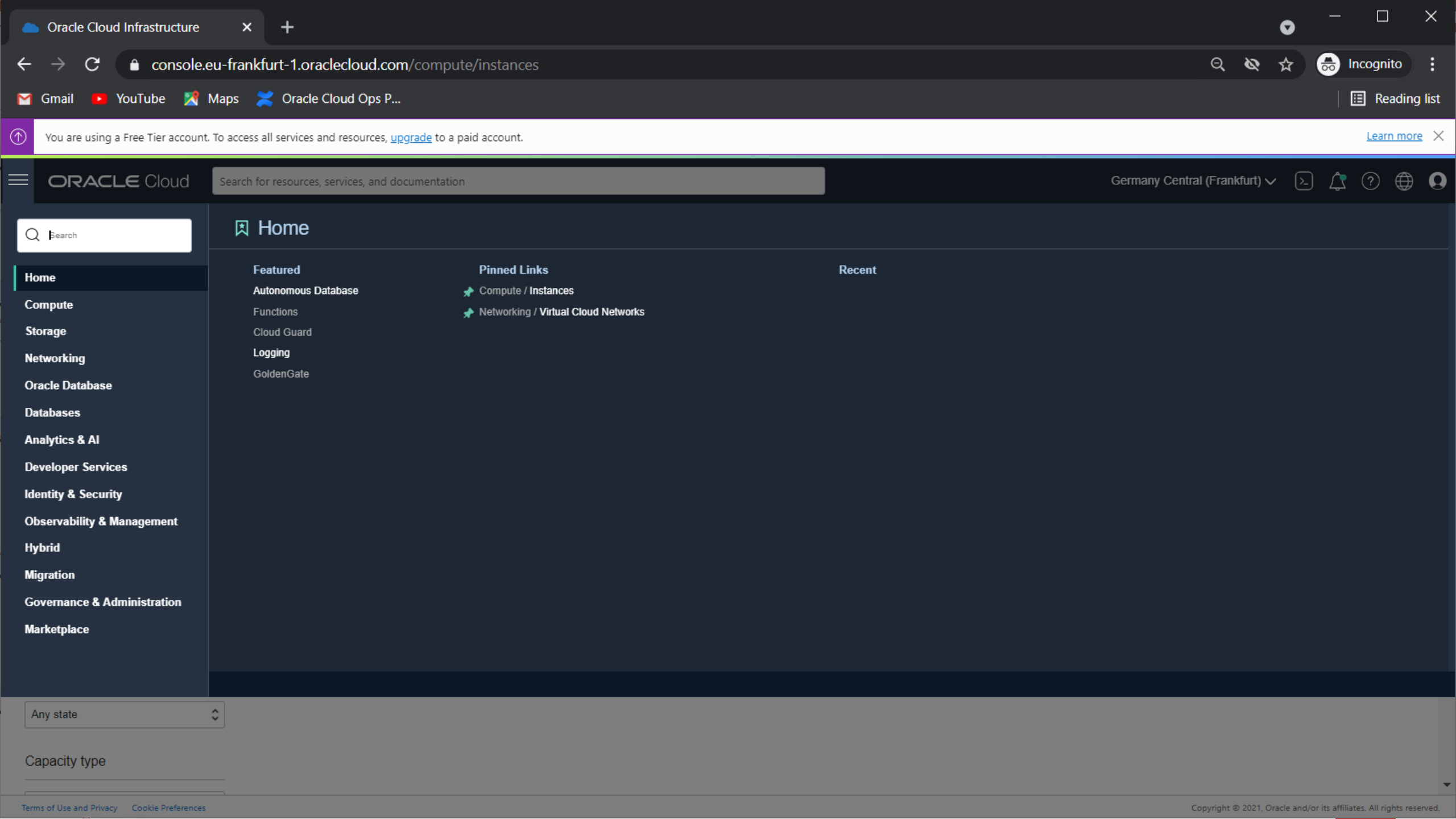
- Create Autonomous Database, Always free
 - Not required step, we will offer tables for you to use
- Create Account for the Lab

Table Preparation

- Using ORDS
- Using SODA



Create Autonomous ATP database



📌

 You are using a Free Tier account. To access all services and resources, [upgrade](#) to a paid account.[Learn more](#) ✕

☰

 ORACLE Cloud

Search for resources, services, and documentation

Germany Central (Frankfurt) ▾

🔧

🔔

?

🌐

👤

Overview » Autonomous Database » Autonomous Databases

Autonomous Database

Autonomous Database

Dedicated Infrastructure ⓘ

Autonomous Container Database

Autonomous Exadata Infrastructure

List Scope

Compartment

ios62 (root) ▾

Filters

Workload Type

Transaction Processing ▾

State

Any state ▾

Tag Filters

[add](#) | [clear](#)

Autonomous Databases in ios62 (root) *Compartment*

Autonomous Database delivers fast performance and requires no database administration. It performs all routine database maintenance tasks while the system is running, without human intervention. Autonomous Databases located in the Oracle cloud can run on dedicated or shared infrastructure. [Learn more](#).

Create Autonomous Database

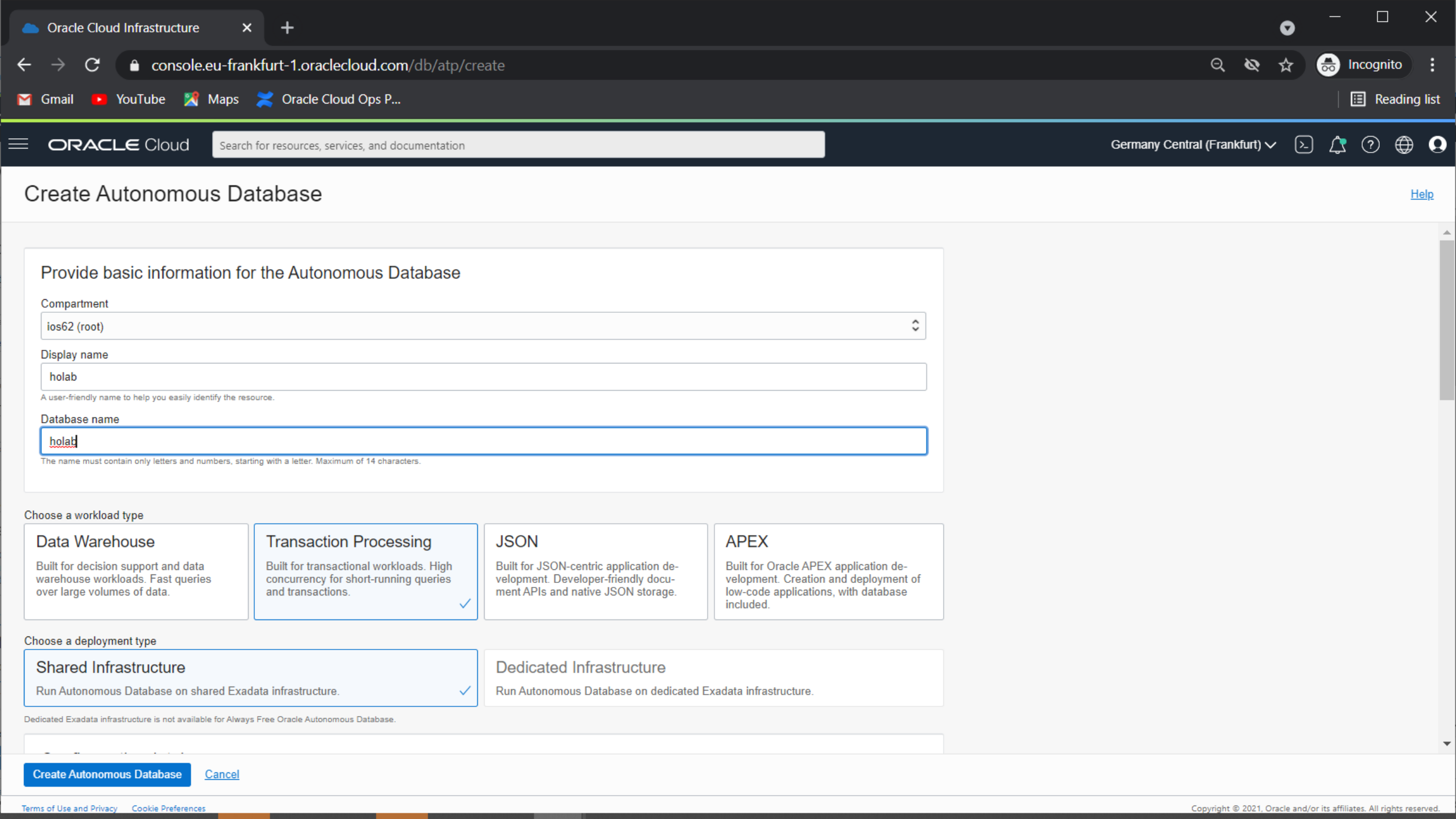
Display Name	State	Dedicated	OCPUs	Storage (TB)	Workload Type	Autonomous Data Guard	Created
No items							

Displaying 0 Autonomous Databases < 1 of 1 >

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Cookie Preferences

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Create Autonomous Database

[Help](#)

Create administrator credentials ⓘ

Username *Read-Only*

ADMIN

ADMIN username cannot be edited.

Password

.....

Confirm password

.....

Choose network access

Access Type

Secure access from everywhere
Restrict access to specified IP addresses and VCNs. ✓

Private endpoint access only
Restrict access to a private endpoint within an OCI VCN.

The virtual cloud network option is not available for Always Free Autonomous Database instances.

☐ Configure access control rules ⓘ

Choose a license type

Bring Your Own License (BYOL)
Bring my organization's Oracle Database software licenses to the Database service. [Learn](#)

License Included
Subscribe to new Oracle Database software licenses and the Database service.

Create Autonomous Database [Cancel](#)

Create Autonomous Database

.....

Choose network access

Access Type

Secure access from everywhere

Restrict access to specified IP addresses and VCNs.

✓

Private endpoint access only

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Bring Your Own License (BYOL)

Bring my organization's Oracle Database software licenses to the Database service. [Learn more.](#)

License Included

Subscribe to new Oracle Database software licenses and the Database service.

✓

Provide up to 10 maintenance contacts

Add Contact

Show Advanced Options

ATP

PROVISIONING

holab Always Free

DB Connection

Performance Hub

🔗 Service Console

Scale Up/Down

More Actions ▾

Autonomous Database Information

Tools

Tags

General Information

Infrastructure

Autonomous Data Guard ⓘ

Backup

Network

Data Safe ⓘ

Database Name: holab

Workload Type: Transaction Processing

Compartment: nose (root)/PreSales/ios_no

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

Created: Sat, May 8, 2021, 04:33:28 UTC

OCPU Count: 1

Storage: 20 GB

License Type: License included

Database Version: 19c

Auto Scaling: Disabled ⓘ

Lifecycle State: Provisioning

Instance Type: Free [Upgrade to Paid](#)

Mode: Read/Write [Edit](#)

APEX Instance

Instance Name: [holab](#)

Dedicated Infrastructure: No

Status: Disabled ⓘ

Last Automatic Backup: No active backups exist for this database.

Manual Backup Store: Not Configured

Access Type: Allow secure access from everywhere

Access Control List: Disabled [Edit](#)

Status: Not Registered [Register](#)

☰

ORACLE Cloud

Search for resources, services, and documentation

Germany Central (Frankfurt) ▾

🔌

🔔

?

🌐

👤

- Autonomous Database
- Autonomous Database
- Dedicated Infrastructure ⓘ
- Autonomous Container Database
- Autonomous Exadata Infrastructure

List Scope

Compartment

ios62 (root) ▾

Filters

Workload Type

All ▾

State

Any state ▾

Tag Filters

[add](#) | [clear](#)

no tag filters applied

Autonomous Databases in ios62 (root) *Compartment*

Autonomous Database delivers fast performance and requires no database administration. It performs all routine database maintenance tasks while the system is running, without human intervention. Autonomous Databases located in the Oracle cloud can run on dedicated or shared infrastructure. [Learn more](#).

Create Autonomous Database

Display Name	State	Dedicated	OCPUs	Storage (TB)	Workload Type	Autonomous Data Guard	Created	
holab Always Free	● Available	No	1	0.02	Transaction Processing	—	Sat, May 8, 2021, 04:33:28 UTC	⋮
iosprojects Always Free	● Available	No	1	0.02	Transaction Processing	—	Mon, Dec 16, 2019, 18:51:16 UTC	⋮

Displaying 2 Autonomous Databases < 1 of 1 >



holab Always Free

DB Connection

Performance Hub

🔗 Service Console

Scale Up/Down

More Actions ▾

Autonomous Database Information

Tools

Tags

General Information

Database Name: holab

Workload Type: Transaction Processing

Compartment: nose (root)/PreSales/ios_no

OCID: ...fwhjjq Show Copy

Created: Sat, May 8, 2021, 04:33:28 UTC

OCPU Count: 1

Storage: 20 GB

License Type: License included

Database Version: 19c

Auto Scaling: Disabled ⓘ

Lifecycle State: Available

Instance Type: Free Upgrade to Paid

Mode: Read/Write Edit

APEX Instance

Instance Name: holab

Infrastructure

Dedicated Infrastructure: No

Autonomous Data Guard ⓘ

Status: Disabled ⓘ

Backup

Last Automatic Backup: No active backups exist for this database.

Manual Backup Store: Not Configured

Network

Access Type: Allow secure access from everywhere

Access Control List: Disabled Edit

Maintenance ⓘ

Next Maintenance: Sat, May 8, 2021, 09:00:00 UTC - 11:00:00 UTC View History

Customer Contacts: None ⓘ Manage

Autonomous Transaction Processing

Overview

Activity

Administration

Development

DATABASE

HOLAB

Download Oracle Instant Client

This is a free, light-weight set of tools, libraries and SDKs for building and connecting applications. These libraries underly the Oracle APIs of languages including Node.js, Python and PHP and provide access for OCI, OCCI, JDBC, ODBC and Pro*C applications. Tools such as SQL*Plus and Oracle Data Pump are also included - Oracle recommends using this version of Data Pump for moving existing Oracle Database schemas to Autonomous Transaction Processing.

Download SODA Drivers

Simple Oracle Document Access (SODA) is a set of APIs for using collections of JSON documents stored in Oracle Database. SODA drivers are available for Java, Node.js, Python, C, PL/SQL, and REST.

Oracle APEX

Oracle APEX is a low code application development framework for building and deploying world-class data centric applications. APEX provides an easy-to-use browser-based environment to load data, manage database objects, develop REST interfaces, and build applications which look and run great on both desktop and mobile devices.

Database Actions

Load, explore, transform, model, and catalog your data. Use a SQL worksheet, build REST interfaces and low-code apps, manage users and connections, build and apply machine learning models.

Oracle Machine Learning Notebooks

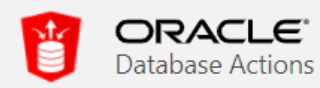
Oracle Machine Learning (OML) Notebooks are a collaborative, Apache

RESTful Services and SODA

Oracle REST Data Services (ORDS) provides HTTPS interfaces for working with



Create datasensor Schema





Username


Password


Sign in


Development

 SQL
Execute queries and scripts, and create database objects


 DATA MODELER
Create relational diagrams for database objects


 REST
Deploy REST APIs for your database


 JSON
Manage your JSON Document Database


 APEX
Build web applications rapidly

Data Tools


 DATA LOAD
Load or access data from local files or remote databases

 CATALOG
Understand data dependencies and the impact of changes

 DATA INSIGHTS
Discover anomalies, outliers and hidden patterns in your data

 BUSINESS MODELS
Create business models for performance and analysis

Administration

 DATABASE USERS
Create, edit privileges and other parameters, and REST-enable database users

Getting Started

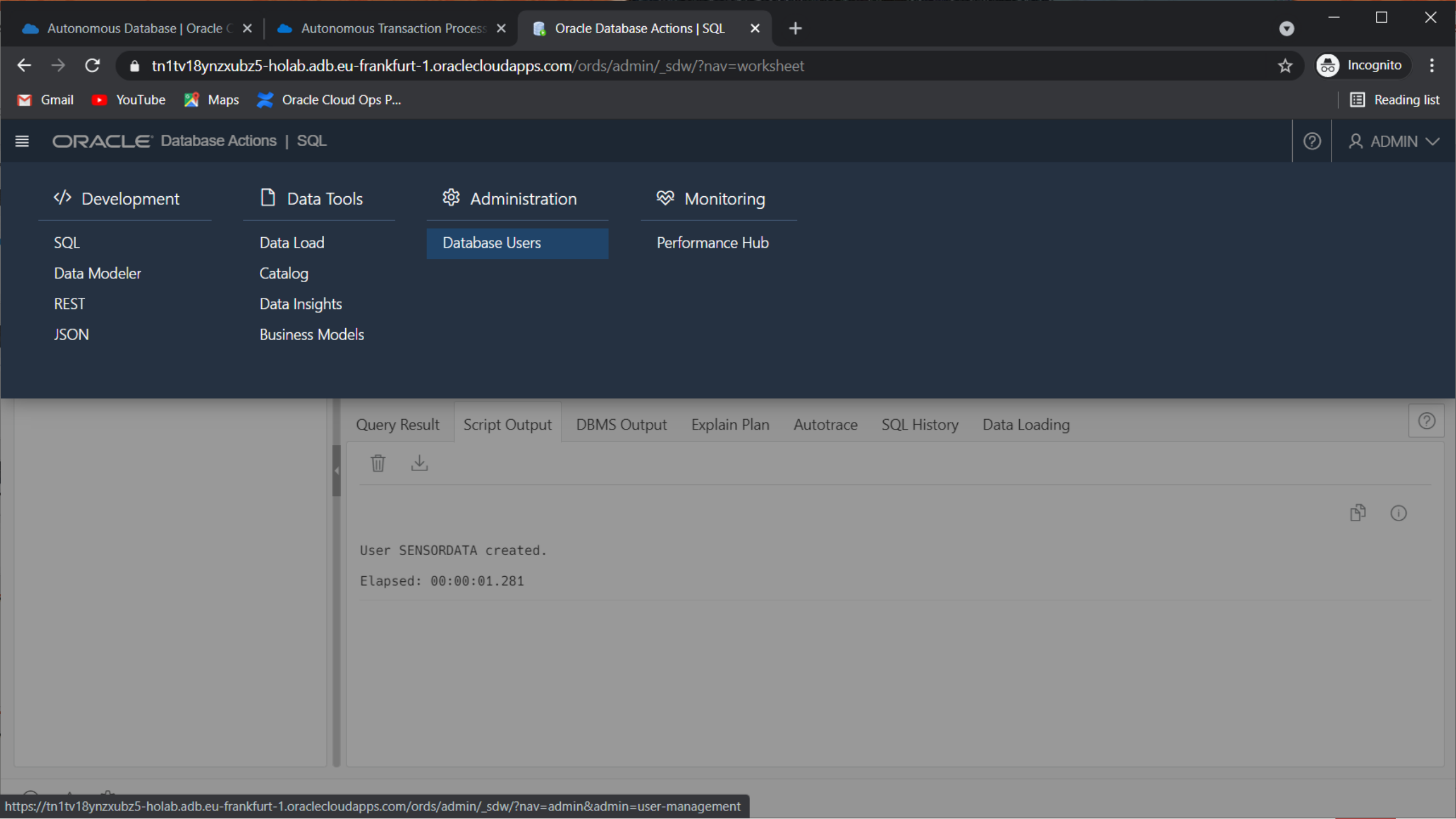
RESTful Web Services
Deploy REST APIs for your Oracle database - GET, PUT, POST and DELETE securely using HTTPS with your Oracle data and stored procedures.

Load Data
Populate existing tables or build new ones from local files (Avro, JSON, XML, CSV, or Excel) using our data loading wizard.


JSON
Create collections, documents, add, edit, delete, and browse your documents, and visualize your JSON Data Guides.

Available On-Premises
SQL Developer Web is now available for your On-Premises Oracle Databases too!

Need Help?
Documentation
SQL Developer Community Forum
SQL Developer on Twitter



Current User



ADMIN

REST Enabled

ORDS Alias: admin

Last Login: 5/8/2021, 4:45:17 AM Password Expires in 122 days


https://tn1tv18ynzxubz5-holab.adb.eu-frankfurt-1.oraclecloudapps.com/ords/admin/_sdw/

All Users


Search by User Name

Filter by

Sort by



ADBSNMP



GGADMIN

Create User

User

0 Granted Roles

User Name *

SENSORDATA

Password *

.....

Confirm Password *

.....

Quota on tablespace DATA

UNLIMITED

Password Expired (user must change)

Account is Locked

Graph ?

OML ?

Web Access ?


Web access advanced features

?

Create User

Cancel

Current User



ADMIN

REST Enabled

ORDS Alias: admin


Last Login: 5/8/2021, 4:45:17 AM Password Expires in 122 days

https://tn1tv18ynzxubz5-holab.adb.eu-frankfurt-1.oraclecloudapps.com/ords/admin/_sdw/

All Users

SENSORDATA

Filter by Sort by



SENSORDATA

Password Expires in 359 days

Edit User

User

1 Granted Roles

Filter by role


x

Role	Granted	Admin	Default
CDB_DBA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CLOUD_INGEST\$IMPL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CLOUD_INGEST_ADMIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CLOUD_INGEST_USER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CONNECT	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CONSOLE_ADMIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CONSOLE_DEVELOPER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CONSOLE_MONITOR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CONSOLE_OPERATOR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CTXAPP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

?

Apply Changes Cancel

Current User




frankfurt-1.oraclecloudapps.com/ords/admin/_sdw/

Password Expires in 122 days

All Users

SENSORDATA

Filter by Sort by



SENSORDATA

Password Expires in 359 days

connect
dwrole
resource
SODA_APP

Edit User

User

4 Granted Roles

Filter by role

Role	Granted	Admin	Default
RECOVERY_CATALOG_USER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RESOURCE	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SCHEDULER_ADMIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SELECT_CATALOG_ROLE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SODA_APP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SYSUMF_ROLE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
XS_CACHE_ADMIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
XS_CONNECT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
XS_NAMESPACE_ADMIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
XS_SESSION_ADMIN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Apply Changes Cancel

Autonomous Database | Oracle

Autonomous Transaction Process

Oracle Database Actions | Database Users

tn1tv18ynzxubz5-holab.adb.eu-frankfurt-1.oraclecloudapps.com/ords/admin/_sdw/?nav=admin&admin=user-management

Gmail

YouTube

Maps

Oracle Cloud Ops P...

ADMIN

ADMIN

Current User

ADMIN

REST Enabled

ORDS Alias: admin

Last Login: 5/8/2021, 4:45:17 AM

Password Expires in 122 days

https://tn1tv18ynzxubz5-holab.adb.eu-frankfurt-1.oraclecloudapps.com/ords/admin/_sdw/

All Users

SENSORDATA

Filter by

Sort by

Page Size: 20

Sort by User Name: ASC

SENSORDATA

Password Expires in 359 days





Edit

Enable REST

Drop REST Services

Enable Graph

Delete

	HOLAB20 Last Login: 1/7/2020, 12:34:49 PM	
	IOS Last Login: 5/8/2021, 5:15:02 AM Password Expires in 217 days	
	IOS62 Password Expires in 222 days	
	RMAN\$VPC	

REST Enable User

Enable Schema:
SENSORDATA

URL Mapping Type:
BASE_PATH

Schema Alias: *
sensordata

Authorization required:
☐

?

REST Enable User

Cancel



Build ORDS REST API

Create table and enable ORDS REST

ORDS/REST Enable schema (Already done, required for Database Actions)

Create table

ORDS/REST enable table

Define Module

Define Template

Define Handlers


- GET handler for search


- PUT handler for insert


Create ORDS REST Interface Screenshot




Development


 SQL
Execute queries and scripts, and create database objects

 DATA MODELER
Create relational diagrams for database objects


 REST
Deploy REST APIs for your database

 JSON
Manage your JSON Document Database

Administration

 DATABASE USERS
Create, edit privileges and other parameters, and REST-enable database users

Monitoring

 REAL TIME SQL MONITOR
Monitor executed SQL queries in real time

Getting Started

- RESTful Web Services

Deploy REST APIs for your Oracle database - GET, PUT, POST and DELETE securely using HTTPS with your Oracle data and stored procedures.
- Load Data

Populate existing tables or build new ones from local files (Avro, JSON, XML, CSV, or Excel) using our data loading wizard.
- JSON

Create collections, documents, add, edit, delete, and browse your documents, and visualize your JSON Data Guides.
- Available On-Premises

SQL Developer Web is now available for your On-Premises Oracle Databases too!

- Need Help?
- Documentation
- SQL Developer Community Forum
- SQL Developer on Twitter

Navigator Worksheets

SENSORDATA

Tables

Search...

[Worksheet]*

```
1 create table sensors (id NUMBER GENERATED ALWAYS as IDENTITY(START with 1 INCREMENT by 1) primary key,
2 .....
3 .....
4 .....
5 .....
   create_time timestamp default systimestamp,
   objectname varchar2(20),
   sensorname varchar2(20),
   sensorvalue varchar2(20));
```

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Table SENSORS created.
Elapsed: 00:00:00.061

Autonomous Transaction Process

Oracle Database Actions | SQL

tn1tv18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/_sdw/?nav=worksheet

AppsGmailYouTubeMapsOracle Cloud Ops P...Reading list

ORACLE Database Actions | SQLSENSORDATA

Navigator

Worksheets

SENSORDATA

Tables

Search...

1begin

2insert into sensors (objectname,sensorname,sensorvalue) values ('test','temp','22.0');

3insert into sensors (objectname,sensorname,sensorvalue) values ('test','temp','23.0');

4insert into sensors (objectname,sensorname,sensorvalue) values ('test','temp','24.0');

5commit;

6end;

7/

Query ResultScript OutputDBMS OutputExplain PlanAutotraceSQL HistoryData Loading

Table SENSORS created.

Elapsed: 00:00:00.061

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.111

tn1tv18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/_sd...

Navigator Worksheets

SENSORDATA

Tables

Search...

[Worksheet]*

```
1 DECLARE
2   PRAGMA AUTONOMOUS_TRANSACTION;
3 BEGIN
4   ORDS.ENABLE_OBJECT(p_enabled => TRUE,
5                       p_schema => 'SENSORDATA',
6                       p_object => 'SENSORS',
7                       p_object_type => 'TABLE',
8                       p_object_alias => 'sensorapi',
9                       p_auto_rest_auth => FALSE);
10
11   commit;
12
13 END;
14 /
```

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Elapsed: 00:00:00.131

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.093

Navigator Worksheets

SENSORDATA

Tables

Search...

[Worksheet]*

```
1 begin
2 ORDS.DEFINE_MODULE(
3     p_module_name => 'sensors',
4     p_base_path   => 'sensors',
5     p_items_per_page => 0,
6     p_status      => 'PUBLISHED',
7     p_comments    => NULL);
8 ORDS.DEFINE_TEMPLATE(
9     p_module_name => 'sensors',
10    p_pattern      => 'iotapi/',
11    p_priority     => 0,
12    p_etag_type    => 'HASH',
13    p_etag_query   => NULL,
14    p_comments     => NULL);
15 ORDS.DEFINE_TEMPLATE(
16     p_module_name => 'sensors',
17     p_pattern      => 'iotapi/:objectname',
18     p_priority     => 0,
```

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Elapsed: 00:00:00.380

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.131

Navigator Worksheets

SENSORDATA

Tables

Search...

[Worksheet]*

```
1 begin
2 ORDS.DEFINE_MODULE(
3     p_module_name => 'sensors',
4     p_base_path   => 'sensors',
5     p_items_per_page => 0,
6     p_status      => 'PUBLISHED',
7     p_comments    => NULL);
8 ORDS.DEFINE_TEMPLATE(
9     p_module_name => 'sensors',
10    p_pattern      => 'iotapi/',
11    p_priority     => 0,
12    p_etag_type    => 'HASH',
13    p_etag_query   => NULL,
14    p_comments     => NULL);
15 ORDS.DEFINE_TEMPLATE(
16     p_module_name => 'sensors',
17     p_pattern      => 'iotapi/:objectname',
18     p_priority     => 0
```

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Elapsed: 00:00:00.093

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.017

Navigator Worksheets

SENSORDATA

Tables

Search...

[Worksheet]*

```
1 begin
2 ORDS.DEFINE_HANDLER(
3     p_module_name => 'sensors',
4     p_pattern      => 'iotapi/',
5     p_method       => 'GET',
6     p_source_type  => 'json/collection',
7     p_items_per_page => 0,
8     p_mimes_allowed => '',
9     p_comments     => NULL,
10    p_source        =>
11    'select create_time,sensorname, sensorvalue from sensors'
12    );
13 commit;
14 end;
15 /
```

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Elapsed: 00:00:00.017

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.034

Navigator Worksheets

SENSORDATA

Tables

Search...

[Worksheet]*

```
1 begin
2 ORDS.DEFINE_HANDLER(
3     p_module_name => 'sensors',
4     p_pattern      => 'iotapi/:objectname',
5     p_method       => 'GET',
6     p_source_type  => 'json/collection',
7     p_items_per_page => 0,
8     p_mimes_allowed => '',
9     p_comments     => NULL,
10    p_source       =>
11    'select create_time,sensorname,sensorvalue from sensors where objectname=:objectname'
12    );
13 commit;
14 end;
15 /
```

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Elapsed: 00:00:00.034

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.019

Navigator Worksheets

SENSORDATA

Tables

Search...

[Worksheet]*

```
1 begin
2   ORDS.DEFINE_HANDLER(
3     p_module_name => 'sensors',
4     p_pattern      => 'iotapi/',
5     p_method       => 'POST',
6     p_source_type  => 'plsql/block',
7     p_items_per_page => 0,
8     p_mimes_allowed => 'application/json',
9     p_comments     => NULL,
10    p_source       =>
11  'declare
12    id sensors.id%type;
13  BEGIN
14    INSERT INTO sensors(objectname, sensorname, sensorvalue)
15      VALUES (:objectname, :sensorname, :sensorvalue)
16    RETURNING ID INTO id;
17    :status := 201;
18  END;'
19  );
20  COMMIT;
```

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.015

Create ORDS REST Interface Source code

Create table and add dummy data

```
create table sensors (id NUMBER GENERATED ALWAYS as IDENTITY(START with 1 INCREMENT by 1) primary key,  
                      create_time timestamp default systimestamp,  
                      objectname varchar2(20),  
                      sensorname varchar2(20),  
                      sensorvalue varchar2(20));
```

```
begin  
insert into sensors (objectname,sensorname,sensorvalue) values('test','temp','22.0');  
insert into sensors (objectname,sensorname,sensorvalue) values('test','temp','23.0');  
insert into sensors (objectname,sensorname,sensorvalue) values('test','temp','24.0');  
commit;  
end;  
/
```

Create ORDS REST Interface Source code

REST enable table

```
DECLARE
  PRAGMA AUTONOMOUS_TRANSACTION;
BEGIN
  ORDS.ENABLE_OBJECT(p_enabled => TRUE,
                    p_schema => 'SENSORDATA',
                    p_object => 'SENSORS',
                    p_object_type => 'TABLE',
                    p_object_alias => 'sensorapi',
                    p_auto_rest_auth => FALSE);

  commit;

END;
/
```


Create ORDS REST Interface Source code

Define ORDS Module

```
begin
ORDS.DEFINE_MODULE (
    p_module_name      => 'sensors',
    p_base_path         => 'sensors',
    p_items_per_page    => 0,
    p_status            => 'PUBLISHED',
    p_comments          => NULL);
ORDS.DEFINE_TEMPLATE (
    p_module_name      => 'sensors',
    p_pattern           => 'iotapi/',
    p_priority          => 0,
    p_etag_type         => 'HASH',
    p_etag_query        => NULL,
    p_comments          => NULL);
ORDS.DEFINE_TEMPLATE (
    p_module_name      => 'sensors',
    p_pattern           => 'iotapi/:objectname',
    p_priority          => 0,
    p_etag_type         => 'HASH',
    p_etag_query        => NULL,
    p_comments          => NULL);
commit;
end;
```

Create ORDS REST Interface Source code

Define ORDS GET all handler

```
begin
ORDS.DEFINE_HANDLER(
  p_module_name      => 'sensors',
  p_pattern           => 'iotapi/',
  p_method            => 'GET',
  p_source_type       => 'json/collection',
  p_items_per_page    => 0,
  p_mimes_allowed     => '',
  p_comments          => NULL,
  p_source            =>
'select object_name,create_time,sensorname, sensorvalue from sensors'
);
commit;
end;
/
```

Create ORDS REST Interface Source code

Define ORDS GET handler with where clause

```
begin
ORDS.DEFINE_HANDLER(
  p_module_name      => 'sensors',
  p_pattern           => 'iotapi/:objectname',
  p_method            => 'GET',
  p_source_type       => 'json/collection',
  p_items_per_page    => 0,
  p_mimes_allowed     => '',
  p_comments          => NULL,
  p_source            =>
'select create_time,sensorname, sensorvalue from sensors where objectname=:objectname'
);
commit;
```

Create ORDS REST Interface Source code

Define ORDS post handler for INSERT

```
begin
  ORDS.DEFINE_HANDLER(
    p_module_name      => 'sensors',
    p_pattern           => 'iotapi/',
    p_method            => 'POST',
    p_source_type       => 'plsql/block',
    p_items_per_page    => 0,
    p_mimes_allowed     => 'application/json',
    p_comments          => NULL,
    p_source            =>
'declare
  id sensors.id%type;
BEGIN
  INSERT INTO sensors(objectname, sensorname, sensorvalue)
    VALUES (:objectname,:sensorname,:sensorvalue)
  RETURNING ID INTO id;
  :status := 201;
END;'
    );
  COMMIT;
END;
/
```

What is my REST URL?

As an example assume your UTL to OCI is

<https://tn1tv18ynzxubz6-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/>

with the following template:

```
ORDS.DEFINE_MODULE( p_module_name => 'sensors', p_base_path => 'sensors',  
                    p_items_per_page => 0, p_status => 'PUBLISHED', p_comments => NULL);
```

```
ORDS.DEFINE_TEMPLATE( p_module_name => 'sensors', p_pattern => 'iotapi/', p_priority => 0,  
                      p_etag_type => 'HASH', p_etag_query => NULL, p_comments => NULL);
```

URL: To OCI Console: <https://tn1tv18ynzxubz6-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/>

DB Schema: sensordata

Template module name: sensors

pattern: iotapi/

The full URL for user sensordata will then be:

<https://tn1tv18ynzxubz6-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/sensors/iotapi/>

REST Insert with Post

Request

POST

iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/sensors/iotapi/

Send request

Headers

Content-Type

application/json

+Add header

Basic auth

Request body

Type

Custom

```
{"objectname":"test3","sensorname":"rpm","sensorvalue":"850"}
```


Response (0.235s) - https://tn1tv18ynxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/sensors/iotapi/

200 OK

Headers

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11.05.2021



REST GET

Fetch all

Request

GET

ixubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/sensors/iotapi/

Send request

Headers

Content-Type

application/json

+Add header

Basic auth

Username

Password

☒ Show password?

Response (1.16s) - https://tn1tv18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/sensors/iotapi/

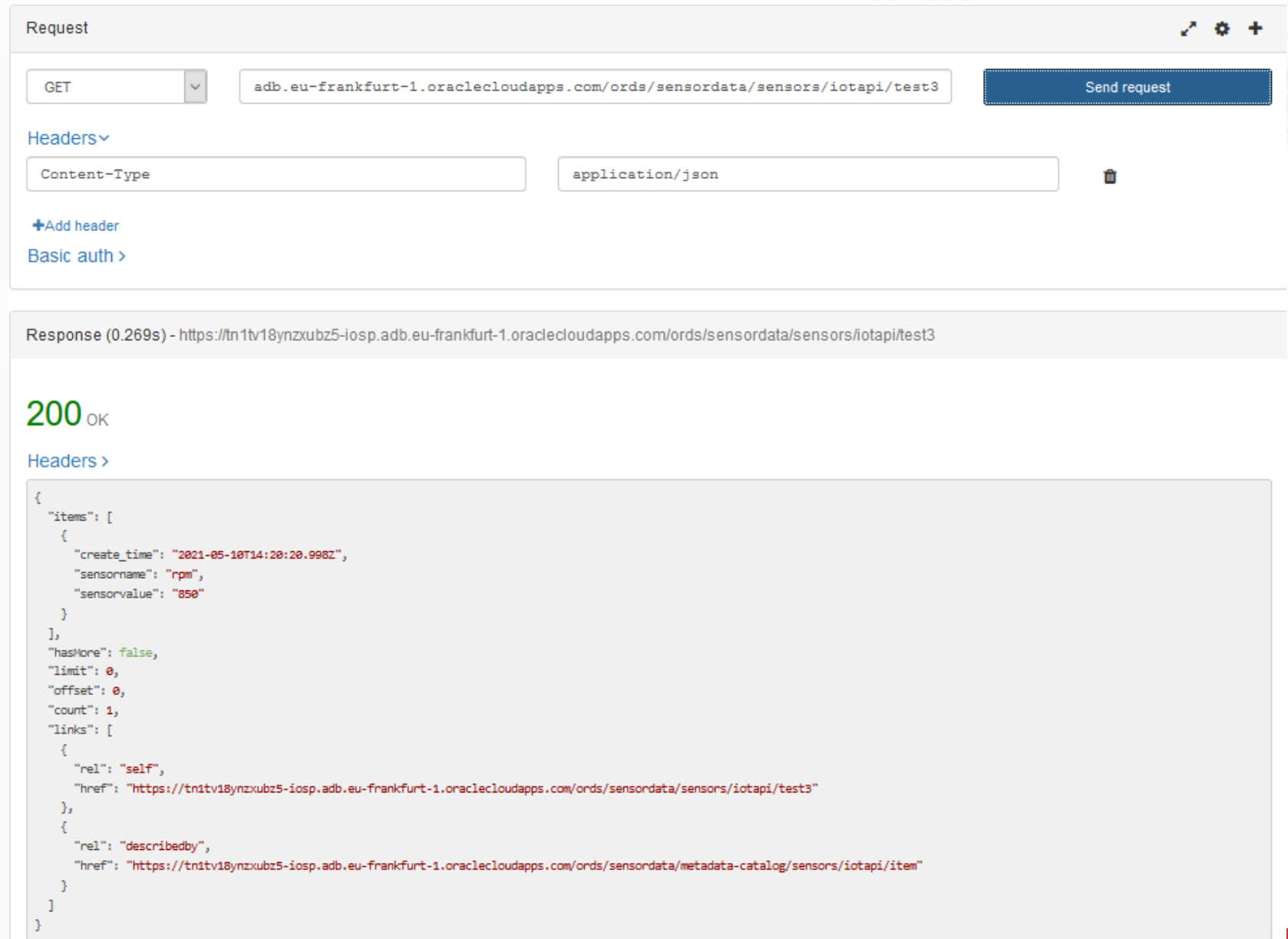
200 OK

Headers >

The size of the response is greater than 20KB, syntax highlighting has been disabled for performance reasons.

```
{
  "items": [
    {
      "objectname": "FrodeTest",
      "create_time": "2021-05-10T18:11:54.098Z",
      "sensorname": "TempMC",
      "sensorvalue": "22570"
    }
  ]
}
```

REST GET fetch with where



The screenshot displays a REST client interface. The top section, titled "Request", shows a GET method being used on the URL `adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/sensors/iotapi/test3`. A "Send request" button is visible. Below the URL bar, the "Headers" section is expanded, showing a single header: `Content-Type: application/json`. There is an "Add header" link and a "Basic auth" link. The bottom section, titled "Response (0.269s)", shows the response status as **200 OK**. The response body is a JSON object with the following structure:

```
{
  "items": [
    {
      "create_time": "2021-05-10T14:20:20.998Z",
      "sensorname": "rpm",
      "sensorvalue": "850"
    }
  ],
  "hasMore": false,
  "limit": 0,
  "offset": 0,
  "count": 1,
  "links": [
    {
      "rel": "self",
      "href": "https://tn1tv18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/sensors/iotapi/test3"
    },
    {
      "rel": "describedby",
      "href": "https://tn1tv18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/metadata-catalog/sensors/iotapi/item"
    }
  ]
}
```




Build SODA JSON Collection

Create SODA Collection

Require to enable user for SODA

PUT Request creates collection

POST Request inserts into collection

GET Request fetches from collection

DELETE Request drops collection

All operations require basic authentication with DB User/password

Prior to work with SODA the following needs to be in place:

- Grant SODA_APP, and resource to the user
- ORDS/REST enable the schema

Autonomous Transaction Process xOracle Database Actions | SQL x

tn1tv18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/_sdw/?nav=worksheet

Apps Gmail YouTube Maps Oracle Cloud Ops P...Reading list

ORACLE Database Actions | SQLSENSORDATA

DevelopmentAdministrationMonitoring

SQLDatabase UsersReal Time SQL Monitor

Data Modeler

REST

JSON

11declare

12id sensors.id%type;

13BEGIN

14INSERT INTO sensors(objectname, sensorname, sensorvalue)

15VALUES (:objectname, :sensorname, :sensorvalue)

16RETURNING ID INTO id;

17status := 201;

18END;

19);

20COMMIT;

Query ResultScript OutputDBMS OutputExplain PlanAutotraceSQL HistoryData Loading

PL/SQL procedure successfully completed.

Elapsed: 00:00:00.015

https://tn1tv18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensordata/_sdw/?nav=application&application=soda

Request

PUT

-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensorapi/soda/latest/iot

Send request

Headers

Content-Type

application/json

+Add header

Basic auth

sensordata

.....

☐ Show password?

Request body

Type

Custom

Response (0.316s) - https://tn1tv18ynxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensorapi/soda/latest/iot

201

Created

Headers >

Request

POST

-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensorapi/soda/latest/iot

Send request

Headers

Content-Type

application/json

+Add header

Basic auth

sensordata

.....

☐ Show password?

Request body

Type

Custom

```
{"objectname": "test4", "sensorname": "rpm", "sensorvalue": "950"}
```

Response (0.296s) - https://tn1tv18ynxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensorapi/soda/latest/iot

201

Created

Headers >

Request

POST

-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensorapi/soda/latest/iot

Send request

Headers

Content-Type

application/json

+Add header

Basic auth

sensordata

.....

☐ Show password?

Request body

Type

Custom

```
{"objectname": "test4", "data": [{"sensorname": "rpm", "sensorvalue": "950"}, {"sensorname": "enginotemp", "sensorvalue": "123,5"}]}
```

Response (0.269s) - https://tn1t18ynzxubz5-iosp.adb.eu-frankfurt-1.oraclecloudapps.com/ords/sensorapi/soda/latest/iot

201

Created

Headers

61 Cop

▼



iot

Navigator Worksheets

SENSORDATA

Tables

Search...

IOT

SENSORS

[Worksheet]*

1 select id, created_on, json_serialize(json_document) as json_data from iot;

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Execution time: 0.004 seconds

	id	created_on	json_data
1	585852C0FF0B4585	2021-05-10T14:27:1	{"objectname":"test4","sensorname":"rpm","sensorvalue":"950"}
2	584907CD3C6B48B	2021-05-10T14:32:5	{"objectname":"test4","data":[{"sensorname":"rpm","sensorvalue":"950"}, {"sensorname":"engin

Navigator Worksheets

SENSORDATA

Tables

Search...

IOT

SENSORS

[Worksheet]*

1 select id, created_on, json_serialize(json_document) as json_data from iot;

Query Result Script Output DBMS Output Explain Plan Autotrace SQL History Data Loading

Execution time: 0.007 seconds

	id	created_on	json_data
1	585852C0FF0B4585	2021-05-10T14:27:1	{"objectname":"test4","sensorname":"rpm","sensorvalue":"950"}