

DOAG 2019

**ORACLE
REST Data Services
(ORDS)**

**JOSEF LIPPERT
FREIBERUFLICHER IT CONSULTANT
MÜNCHEN**

Wer bin ich ...

- Freiberuflicher IT Consultant
 - in der IT seit mehr als 25 Jahren
 - Studium Mathematik
- IT Projekte im Bereich:
 - Oracle-DB (Beratung/Administration/Performance)
 - Oracle Data Guard / Unified Directory (OUD)
 - Data Warehousing
 - UNIX/Linux/Windows/Cloud
 - RZ Infrastruktur Management
 - RZ Automation z. B. CA / Automic UC4 / Dollar Universe
 - DevOps Tätigkeiten
- Email: Josef.Lippert@jal-bs.de

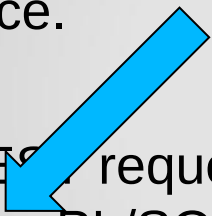
Agenda

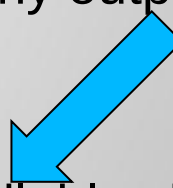
- Einführung
- Installation und Administration
Oracle REST Data Services
- AutoREST Funktionalität für DB Objekte
- REST Development im SQL Developer
- REST Development Insert/Update/Delete
- Secure Access für RESTful Services
- Zusammenfassung

Einführung

■ Auszug Oracle White Paper

„Oracle REST Data Services (ORDS) is a mid-tier technology that serves up RESTful Services for Oracle Database. ORDS enables developers to transform Oracle Database into an easy-to-use RESTful API Service.

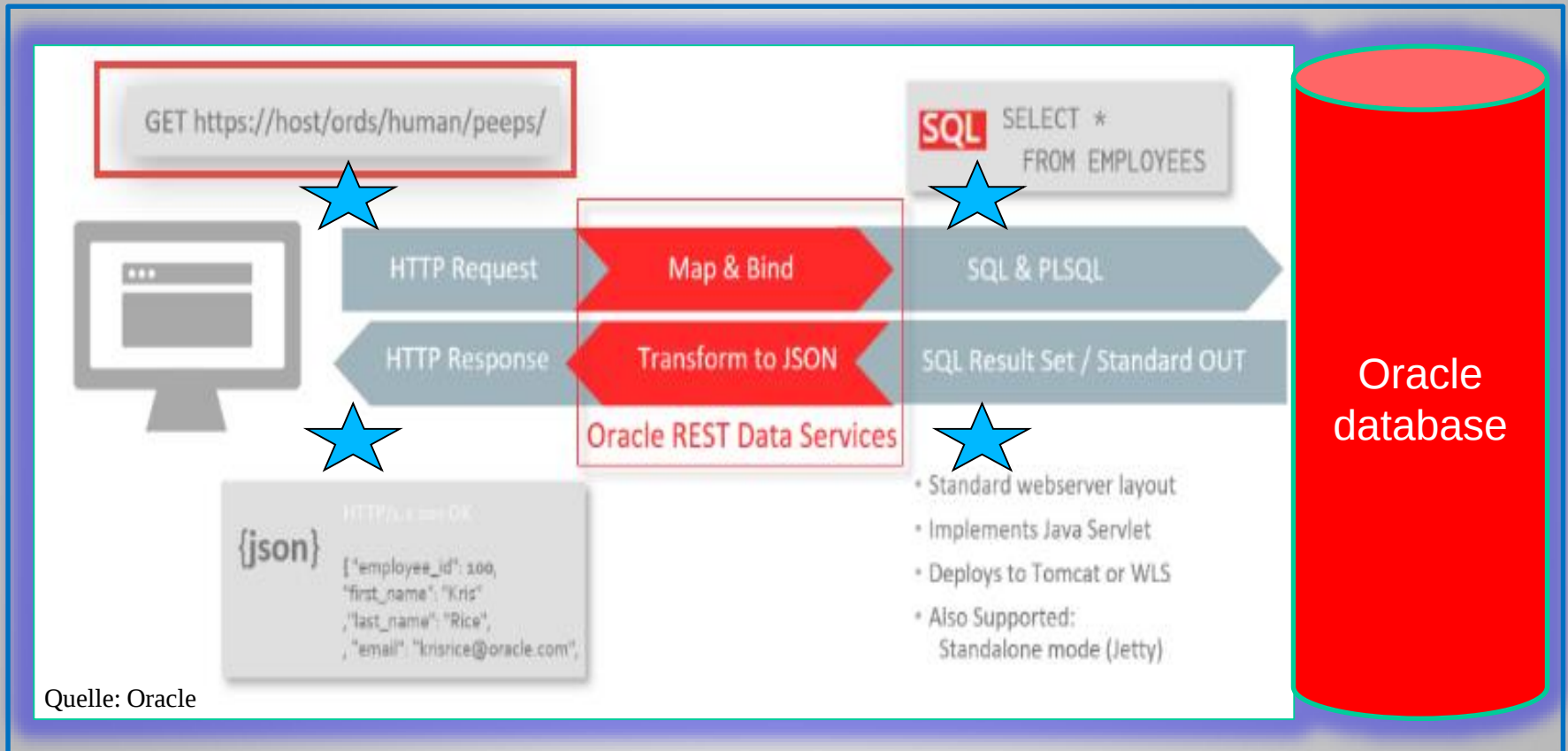
ORDS receives REST requests and marshalls those to Oracle Database as SQL or PL/SQL code blocks, returning any output as a JSON collection back to the calling application. 

With ORDS, any database resource can be made available via REST, and the data access APIs can fully exploit all the power of Oracle Database for the highest performance, reliability and security.”  

Einführung

- Representational State Transfer (kurz: REST)
- Schwerpunktmäßiger Einsatz bei Maschine-zu-Maschine-Kommunikation
- Oracle REST Data Services ist Java EE-basierend
 - Oracle WebLogic Server (WLS)
 - Apache Tomcat
 - GlassFish
 - Standalone Mode (Jetty)
- Alternative zu Oracle HTTP Server und mod_plsql
- Früher „Oracle APEX Listener“ genannt
- Seit Oracle V12.1 fester Auslieferungs-Bestandteil
- Keine Extra-Lizenz erforderlich

Oracle ORDS Architektur



Einführung

- Uniform Operationen für alle Ressourcen
 - PUT, GET, POST, DELETE, HEAD, OPTIONS
- Modelliert Ressourcen, keine Aktionen
 - GET `https://localhost/ords/<schema>/employees/`
 - PUT `https://localhost/ords/<schema>/...`
- Zustandslose Requests via Hyperlinks/URLs
- Text basiertes Protokoll mit einfachem Request/Response Model
- Kleine Anzahl von Status-Codes: 200, 201, 404, 500, ...
- cURL als „command line tool“ nutzbar

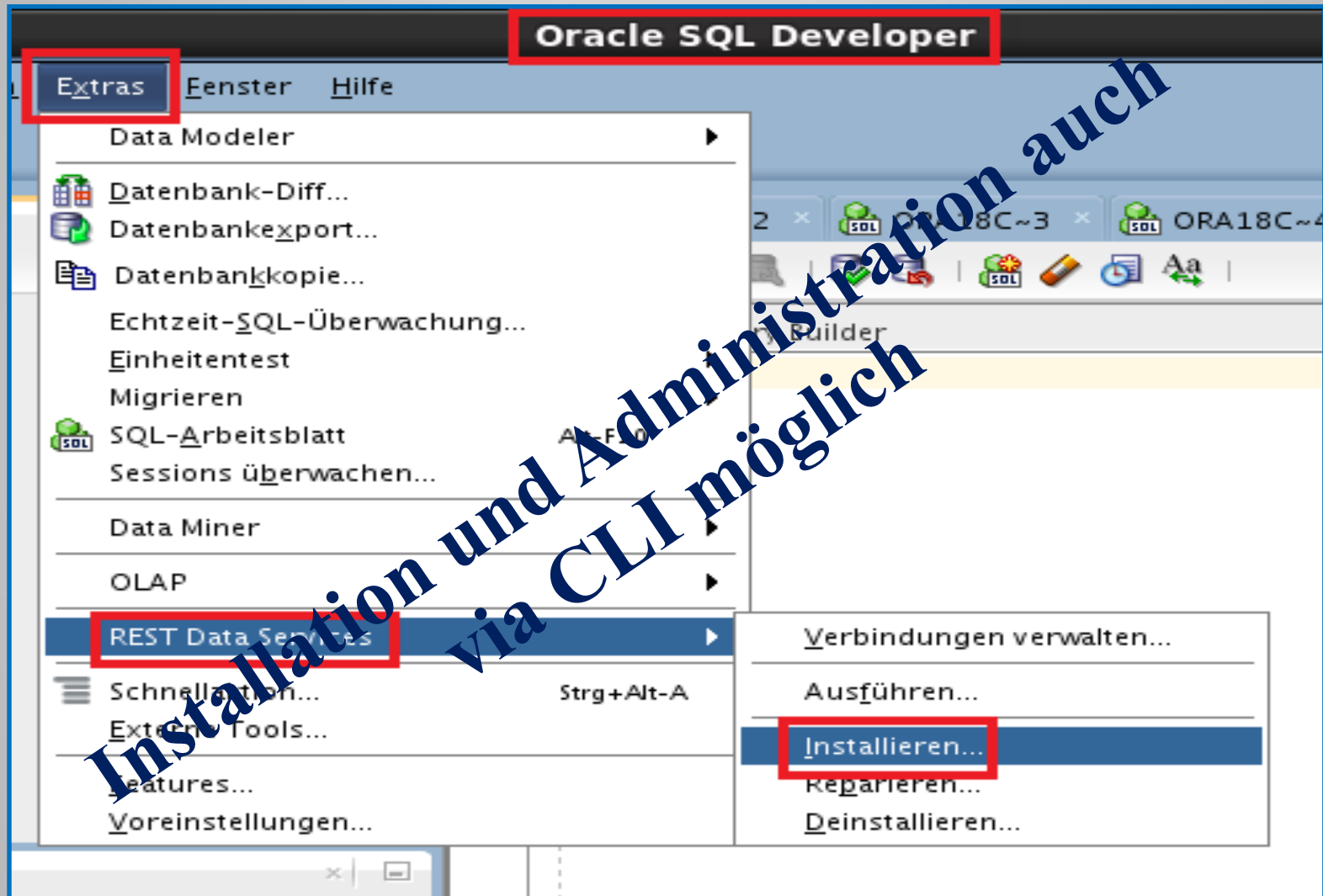
System Voraussetzungen

- Oracle database (EE, SE, SE One) V11.1 or later, 11g R2 Express Edition
- Java JDK 8 or later
- Web browser
 - Microsoft IE 8.0 or later
 - Mozilla Firefox 3.0 or later
 - Google Chrome 2.0 or later
- Supported Java EE Application Servers
 - Oracle WebLogic Server 12g R2 or later
 - Apache Tomcat R8.5 or later
 - (GlassFish Server, Support-Ende angekündigt)
 - Standalone Mode
- Oracle Application Express – keine Voraussetzung
- Hinweis: Bei upgrade 12.1 CDB (Patch 20618595 erforderlich)

Einführung

Methode	Zweck	Datenbank Aktion
GET	Abrufen einer Ressource	select
PUT	Erzeugen, update einer Ressource	merge, update
DELETE	Löschen einer Ressource	delete
POST	Alles mögliche, meist „erzeugen“	insert
HEAD	Abrufen von Metadaten	select
OPTIONS	Methoden-Ressourcen Handling	N/A

Installation und Administration REST Data Services



Installation und Administration REST Data Services

ORDS-Installationsassistent - Schritt 1 von 10

ORDS-Dateispeicherorte

ORDS-Dateispeicher

- Datenbankverbindung**
- Datenbankoptionen
- Tablespaces auswählen
- PL/SQL-Gateway
- APEX RESTful Services
- APEX RESTful Services
- Standalone-Modus au
- ORDS-Benutzer
- Installationszusammenfassung

ORDS WAR-Dateispeicherort

Wählen Sie die Oracle REST Data Services-Datei (ords.war), die für die Installation verwendet werden soll.

☐ Verwenden Sie Oracle REST Data Services, das im Lieferumfang von SQL Developer

☒ Verwenden Sie Oracle REST Data Services im Speicher...

/home/oracle/Downloads/ords.war

Speicherort der Konfigurationsdateien

Geben Sie den Speicherort der Konfigurationsdateien für Oracle REST Data Services

/ora18c/ords

Setzen Sie den Speicherort der Konfigurationsdateien mit dem Wert aus der Datei...

ORDS-Version

Version der ORDS WAR-Datei ist 18.4.0.r3541002

Hilfe < Zurück Weiter > Fertigstellen Abbrechen

Installation und Administration REST Data Services

ORDS-Installationsassistent - Schritt 2 von 5

Datenbankverbindung

Datenbankverbindung

Host: localhost

Port: 1521

☒ Servicename: ORA18c_P1

☐ SID:

Öffentlicher ORDS-Benutzer

Der Proxybenutzer hat Rechte für den Zugriff auf die ORDS RESTful Services.

Benutzername: ORDS_PUBLIC_USER

Kennwort:

Kennwort bestätigen:

☐ Prüfung/Installation des Oracle REST Data Services-Schemas überspringen

Hilfe < Zurück Weiter > Fertigstellen Abbrechen

Installation und Administration REST Data Services

ORDS-Installationsassistent - Schritt 3 von 5

Standalone-Modus ausführen

Standalone-Modus

Oracle REST Data Services enthält einen Webserver, der die Ausführung im Standalone-Modus ermöglicht. Der Standalone-Modus wurde nur zur Verwendung in Entwicklungs- und Testumgebungen konzipiert. Der Standalone-Modus wird NICHT für die Verwendung in Production-Umgebungen unterstützt.

☒ Nach Abschluss der Installation im Standalone-Modus ausführen

HTTP-Port: 8080

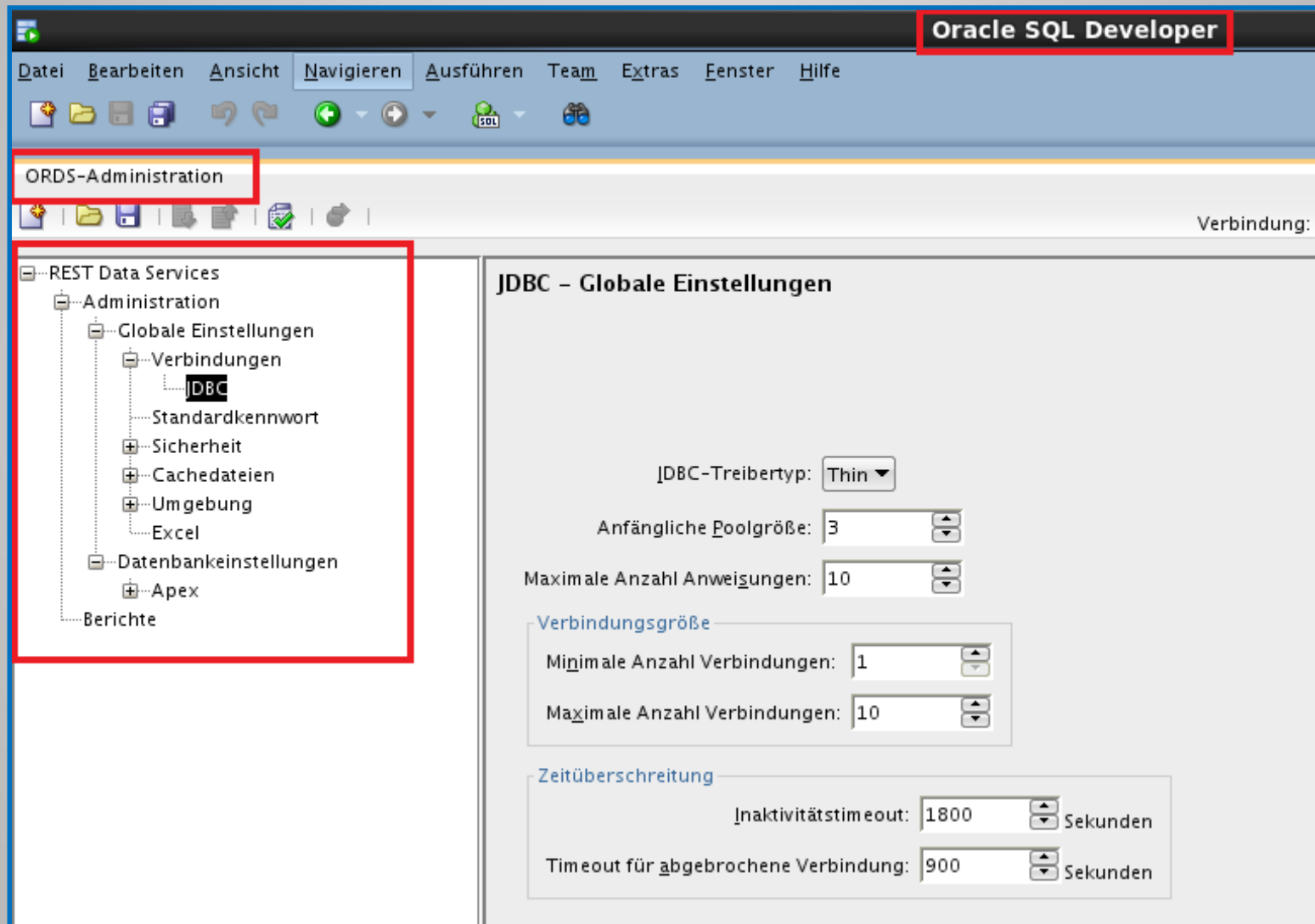
Application Express

Geben Sie den Speicherort der statischen Application Express-Ressourcen an:
images, css usw.
Beispiele: /apex_home/apex/images/, c:/apex_home/apex/images/

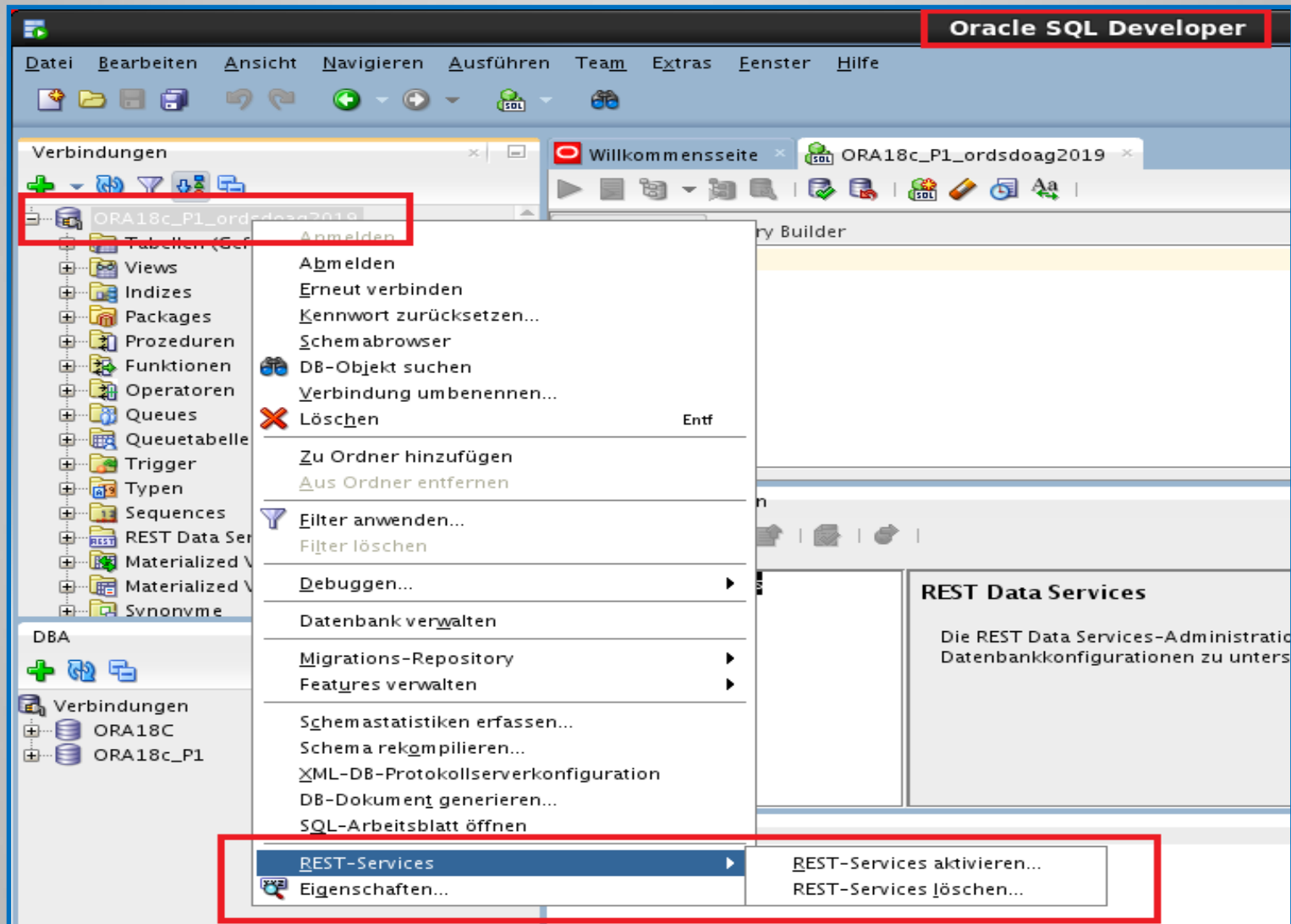
Speicherort der statischen Ressourcen: /ora18c/apex

Hilfe < Zurück Weiter > Fertigstellen Abbrechen

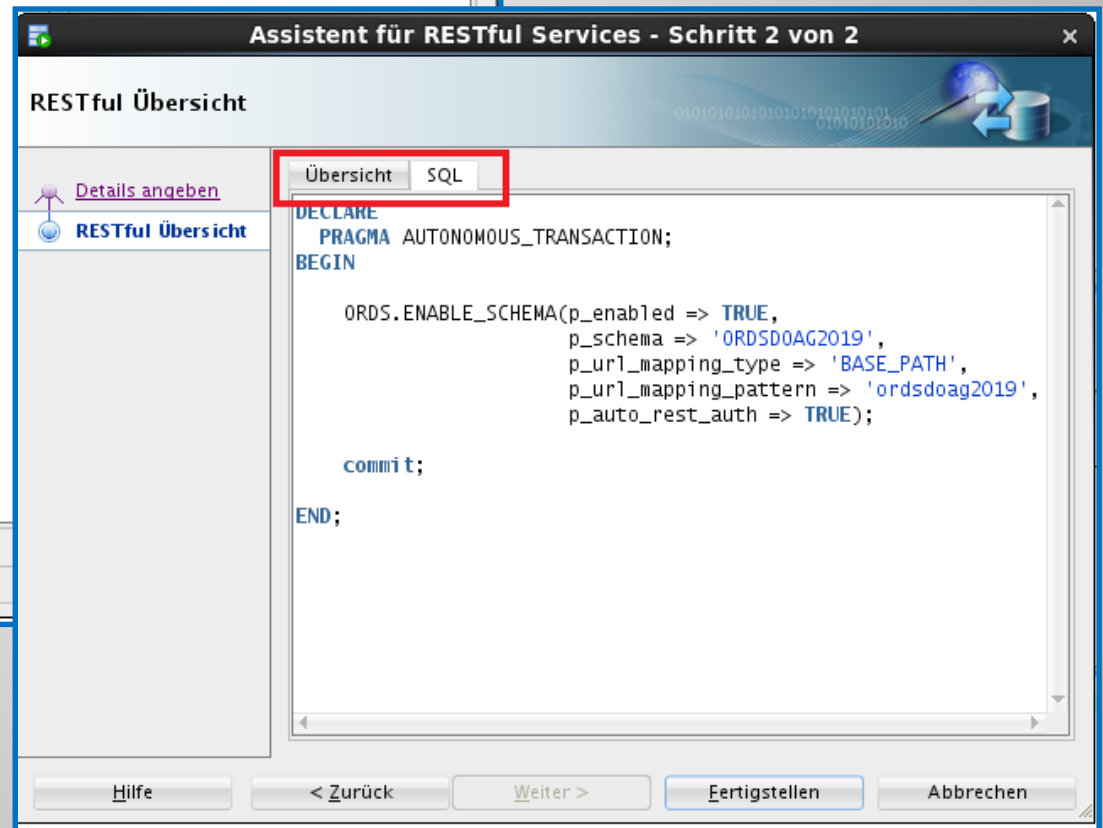
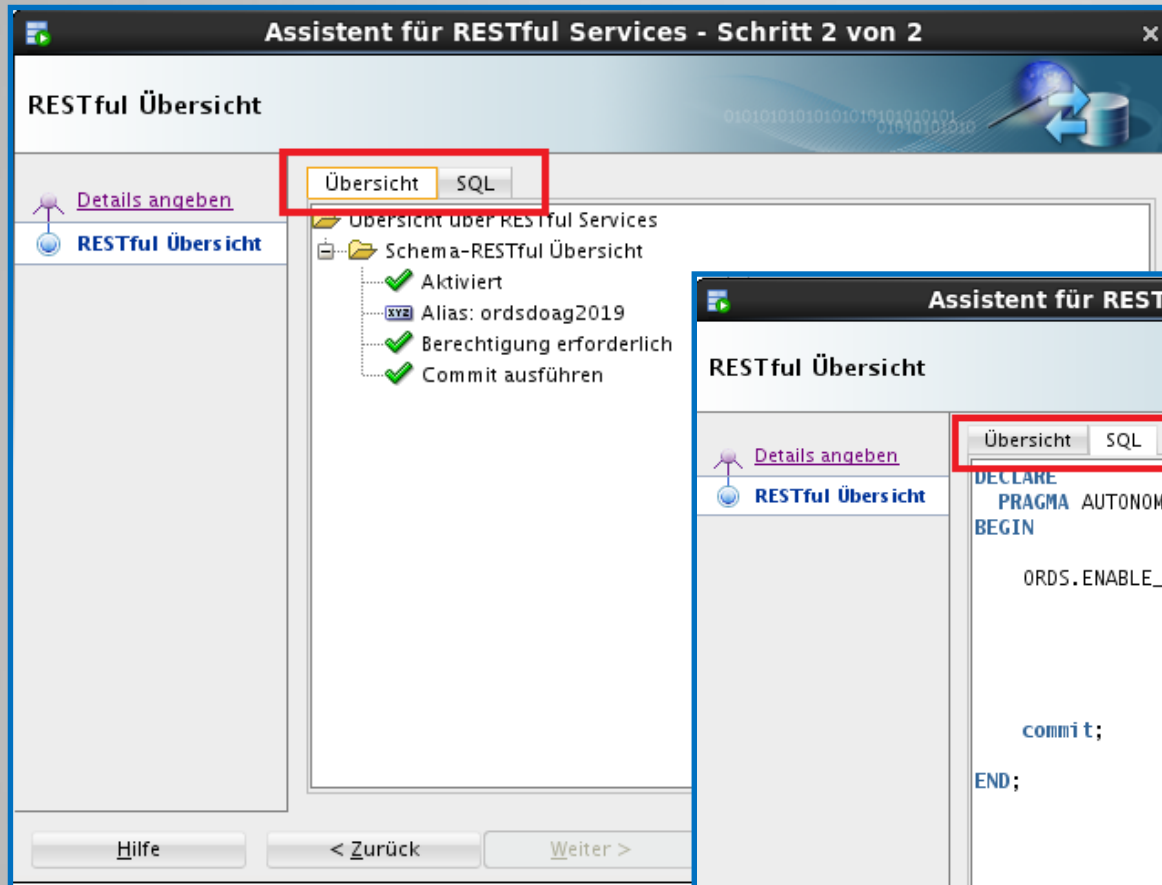
Installation und Administration REST Data Services



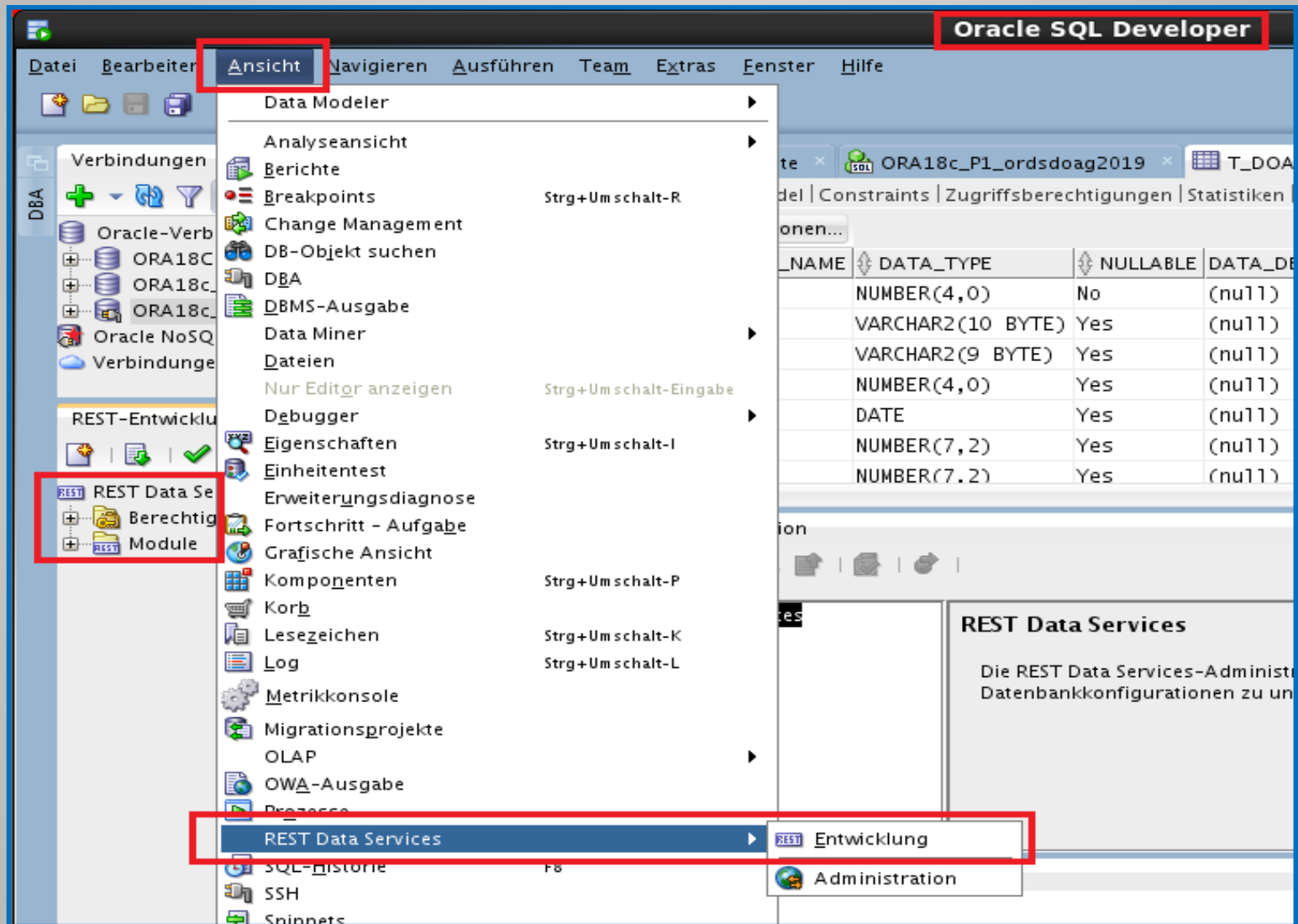
AutoREST Funktionalität für DB Objekte



AutoREST Funktionalität für DB Objekte



REST Development im SQL Developer



REST Development im SQL Developer

The screenshot displays the SQL Developer REST Development environment. On the left, the 'REST-Entwicklung' tree shows the project structure: 'REST Data Services' > 'Berechtigungen' > 'Module' > 'job_count' > 'get_job_count' > 'GET'. The 'job_count' module is highlighted with a red box. On the right, the 'Modul bearbeiten' dialog is open, showing the configuration for the 'job_count' module. The 'Modulname' field is set to 'job_count'. The 'Universal Resource Identifier' section shows the 'URI-Präfix' set to '/job_count/' and a 'Beispiel' (example) URL: 'http://localhost:8080/ords/ordsdoag2019/job_count/'. The 'Veröffentlichen' (Publish) checkbox is checked, indicating the service is available for use. The 'Seitenumbruchsgröße' (Page size) is set to 25. The 'Ursprung zulässig' (Allow origin) checkbox is unchecked. The dialog has buttons for 'Hilfe' (Help), 'Anwenden' (Apply), and 'Abbrechen' (Cancel).

REST-Entwicklung

- REST Data Services
 - Berechtigungen
 - oracle.dbtools.autor...
 - oracle.dbtools.autor...
 - oracle.soda.privilege...
 - Module
 - job_count
 - get_job_count
 - GET

Modul bearbeiten

Modulname: job_count

Universal Resource Identifier

URI-Präfix: /job_count/

Beispiel: http://localhost:8080/ords/ordsdoag2019/job_count/

☒ Veröffentlichen - Diesen RESTful Service zur Verwendung verfügbar machen

Seitenumbruchsgröße: 25

☐ Ursprung zulässig

Hilfe Anwenden Abbrechen

REST Development im SQL Developer

The screenshot displays the SQL Developer REST Development environment. On the left, the 'REST-Entwicklung' tree shows a project named 'REST Data Services' containing a 'Module' folder. Inside the 'Module' folder, the 'job_count' module is selected, and its 'get_job_count' resource is highlighted with a red box. The main window, titled 'Ressourcen-Template bearbeiten', is open. It features a 'Universal Resource Identifier' section with a red border. This section contains a 'URI-Muster' field with the value 'get_job_count' and a 'Beispiel' field showing the full URL: 'http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count'. Below this is a 'Priorität' slider set to 'MEDIUM'. The 'HTTP-Entitytag' section, outlined in blue, shows the 'ETag' field set to 'Sicherer Hash' with a dropdown arrow. Below the field, a text box explains: 'Generieren Sie die Versions-ID mit sicherem Hashing, wodurch die Ressourcenversion eindeutig identifiziert wird.' At the bottom of the dialog are three buttons: 'Hilfe', 'Anwenden', and 'Abbrechen'.

REST-Entwicklung

REST Data Services

Berechtigungen

- oracle.dbtools.autores
- oracle.dbtools.autores
- oracle.soda.privilege.d

Module

- job_count
 - get_job_count

GET

Ressourcen-Template bearbeiten

Universal Resource Identifier

URI-Muster: `get_job_count`

Beispiel: `http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count`

Priorität: LOW MEDIUM HIGH

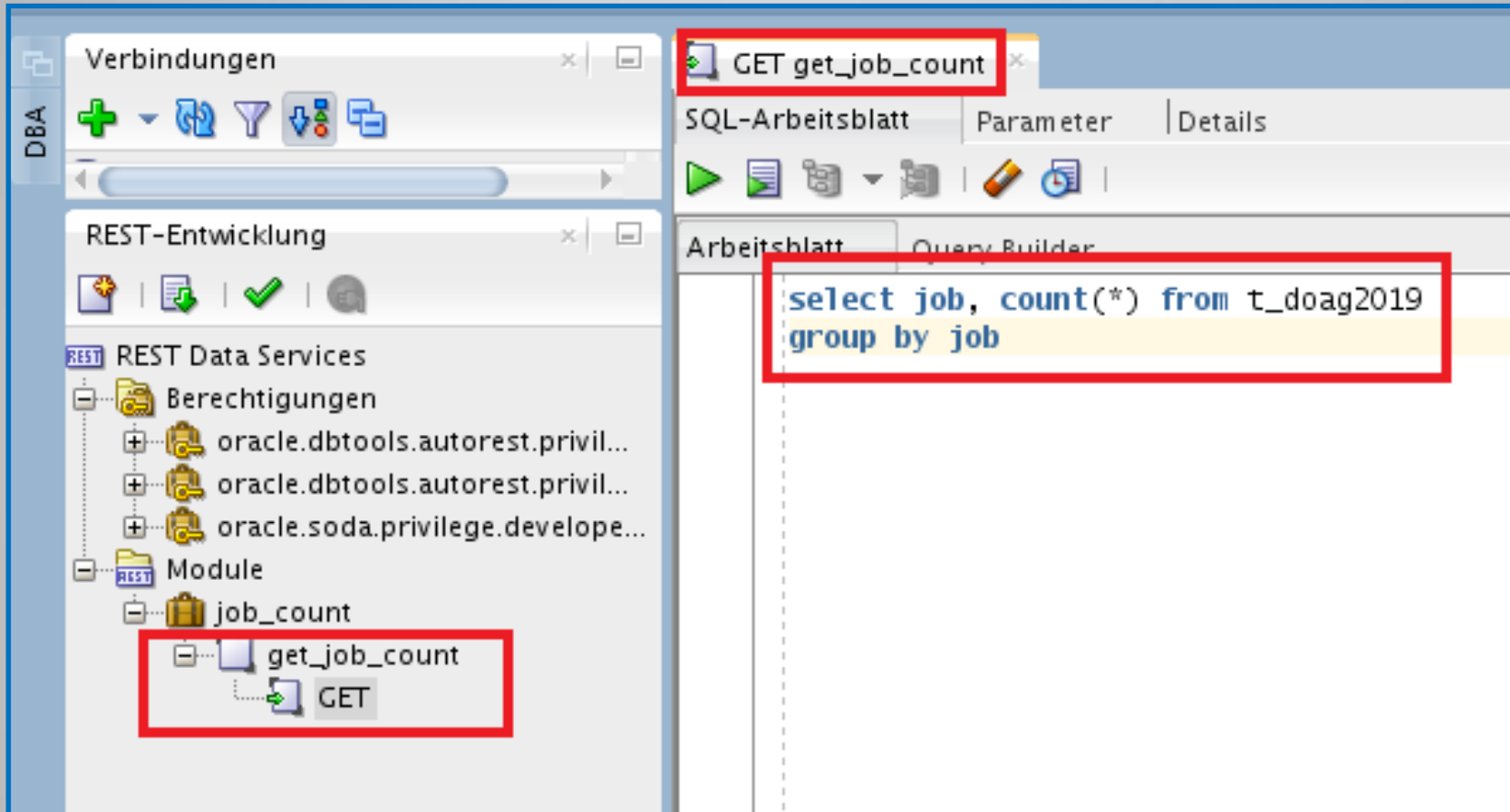
HTTP-Entitytag

ETag: Sicherer Hash ▼

Generieren Sie die Versions-ID mit sicherem Hashing, wodurch die Ressourcenversion eindeutig identifiziert wird.

Hilfe Anwenden Abbrechen

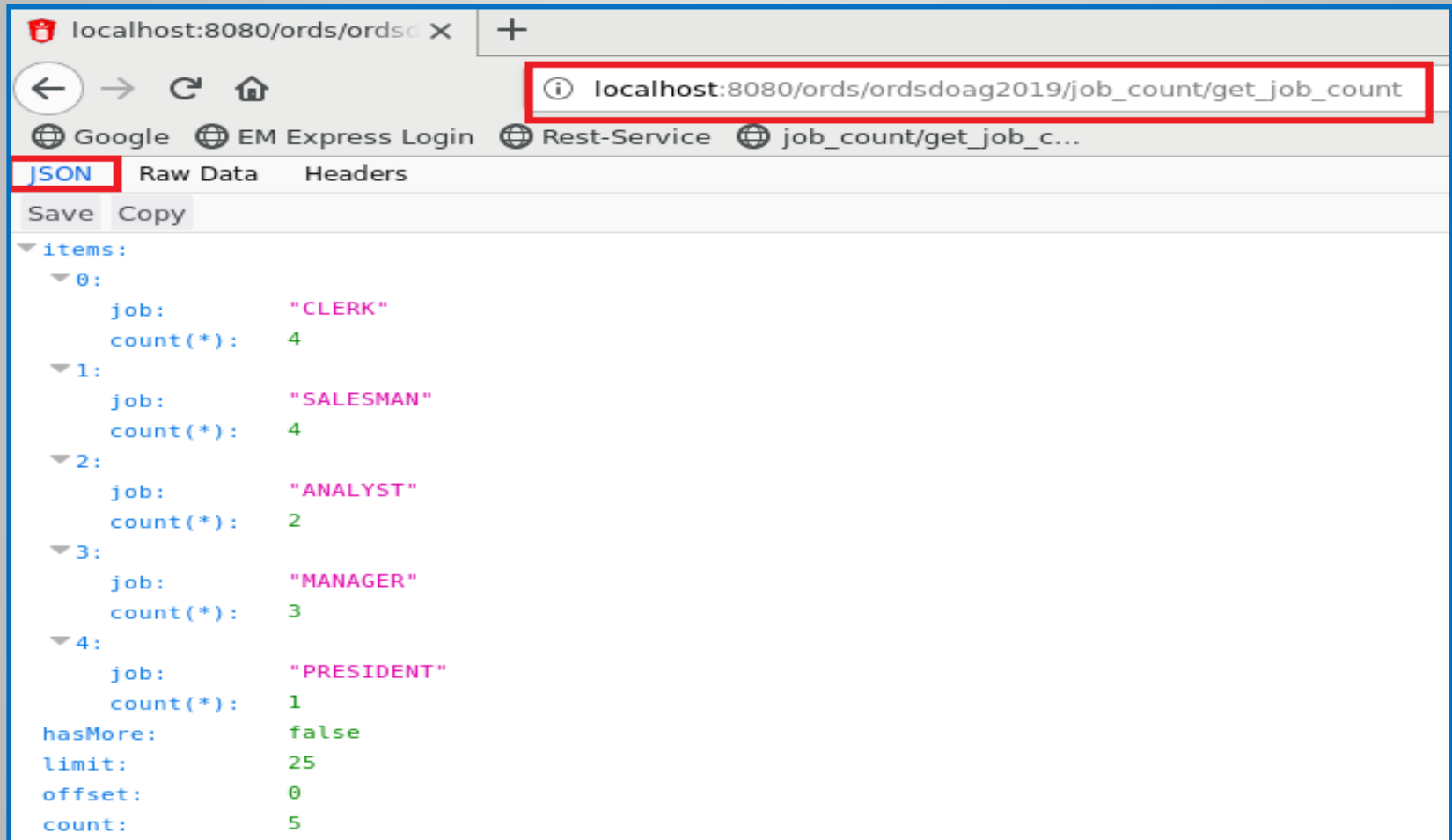
REST Development im SQL Developer



URL: http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count

REST Development GET

URL: http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count



The screenshot shows a web browser window with the URL `localhost:8080/ords/ordsdoag2019/job_count/get_job_count` in the address bar, highlighted by a red rectangle. Below the address bar, the 'JSON' tab is selected, and the response is displayed as a JSON array of job counts. The response is structured as follows:

```
{
  "items": [
    {
      "job": "CLERK",
      "count(*)": 4
    },
    {
      "job": "SALESMAN",
      "count(*)": 4
    },
    {
      "job": "ANALYST",
      "count(*)": 2
    },
    {
      "job": "MANAGER",
      "count(*)": 3
    },
    {
      "job": "PRESIDENT",
      "count(*)": 1
    }
  ],
  "hasMore": false,
  "limit": 25,
  "offset": 0,
  "count": 5
}
```

REST Development GET

URL: http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count

The screenshot shows a web browser window with the URL `localhost:8080/ords/ordsdoag2019/job_count/get_job_count` in the address bar. Below the address bar, there are tabs for 'JSON', 'Raw Data', and 'Headers'. The 'Raw Data' tab is selected. The main content area displays the raw JSON response, which is highlighted with a red box. The JSON response is as follows:

```
{
  "items": [
    {
      "job": "CLERK",
      "count(*)": 4
    },
    {
      "job": "SALESMAN",
      "count(*)": 4
    },
    {
      "job": "ANALYST",
      "count(*)": 2
    },
    {
      "job": "MANAGER",
      "count(*)": 3
    },
    {
      "job": "PRESIDENT",
      "count(*)": 1
    }
  ],
  "hasMore": false,
  "limit": 25,
  "offset": 0,
  "count": 5,
  "links": [
    {
      "rel": "self",
      "href": "http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count"
    },
    {
      "rel": "edit",
      "href": "http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count"
    },
    {
      "rel": "describedby",
      "href": "http://localhost:8080/ords/ordsdoag2019/metadata-catalog/job_count/item"
    },
    {
      "rel": "first",
      "href": "http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count"
    }
  ]
}
```

REST Development GET

URL: `http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count`

The screenshot shows a web browser window with the address bar containing the URL `localhost:8080/ords/ordsdoag2019/job_count/get_job_count`. The browser's developer tools are open, and the 'Headers' tab is selected. The 'Response Headers' section is expanded, showing the following details:

- Content-Security-Policy:** default-src 'none' ; script-src resource;;
- Content-Type:** application/json
- Date:** Thu, 29 Aug 2019 11:46:23 GMT
- ETag:** "v5+Z24VTclmqD196bYDfFeIKI+7dP4C5C/16PK71z2TyZXRcClKvZbjnHTw4USXyyYAfq6i8zTavBR2xHMLVA=="
- Transfer-Encoding:** chunked

The 'Request Headers' section is also expanded, showing the following details:

- Accept:** text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
- Accept-Encoding:** gzip, deflate
- Accept-Language:** en-US,en;q=0.5
- Connection:** keep-alive
- DNT:** 1
- Host:** localhost:8080
- Upgrade-Insecure-Requests:** 1
- User-Agent:** Mozilla/5.0 (X11; Linux x86_64; rv:60.0) Gecko/20100101 Firefox/60.0

REST Development GET

URL: http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count

```
curl -u user:pwd -X GET http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count
```

```
{
  "items": [
    { "job": "CLERK", "count(*)": 4 },
    { "job": "SALESMAN", "count(*)": 4 },
    { "job": "ANALYST", "count(*)": 2 },
    { "job": "MANAGER", "count(*)": 3 },
    { "job": "PRESIDENT", "count(*)": 1 }
  ],
  "hasMore": false,
  "limit": 25,
  "offset": 0,
  "count": 5,
  "links": [
    { "rel": "self", "href": "http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count" },
    { "rel": "edit", "href": "http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count" },
    { "rel": "describedby", "href": "http://localhost:8080/ords/ordsdoag2019/metadata-catalog/job_count/item" },
    { "rel": "first", "href": "http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count" }
  ]
}
```

REST Development Insert/Update/Delete

Verbindungen

- + Sequences
- REST Data Services
 - + Berechtigungen
 - Module
 - job_count
 - get job count
- + Rolle
- + Materialisierte Ansichten
- + Materialisierte Ansichten
- + Synonyme
- + Öffentliche Synonyme

Handler hinzufügen ▶

- Bearbeiten...
- Öffnen
- Löschen...

GET
POST
PUT
DELETE

insert

REST Development Insert/Update/Delete

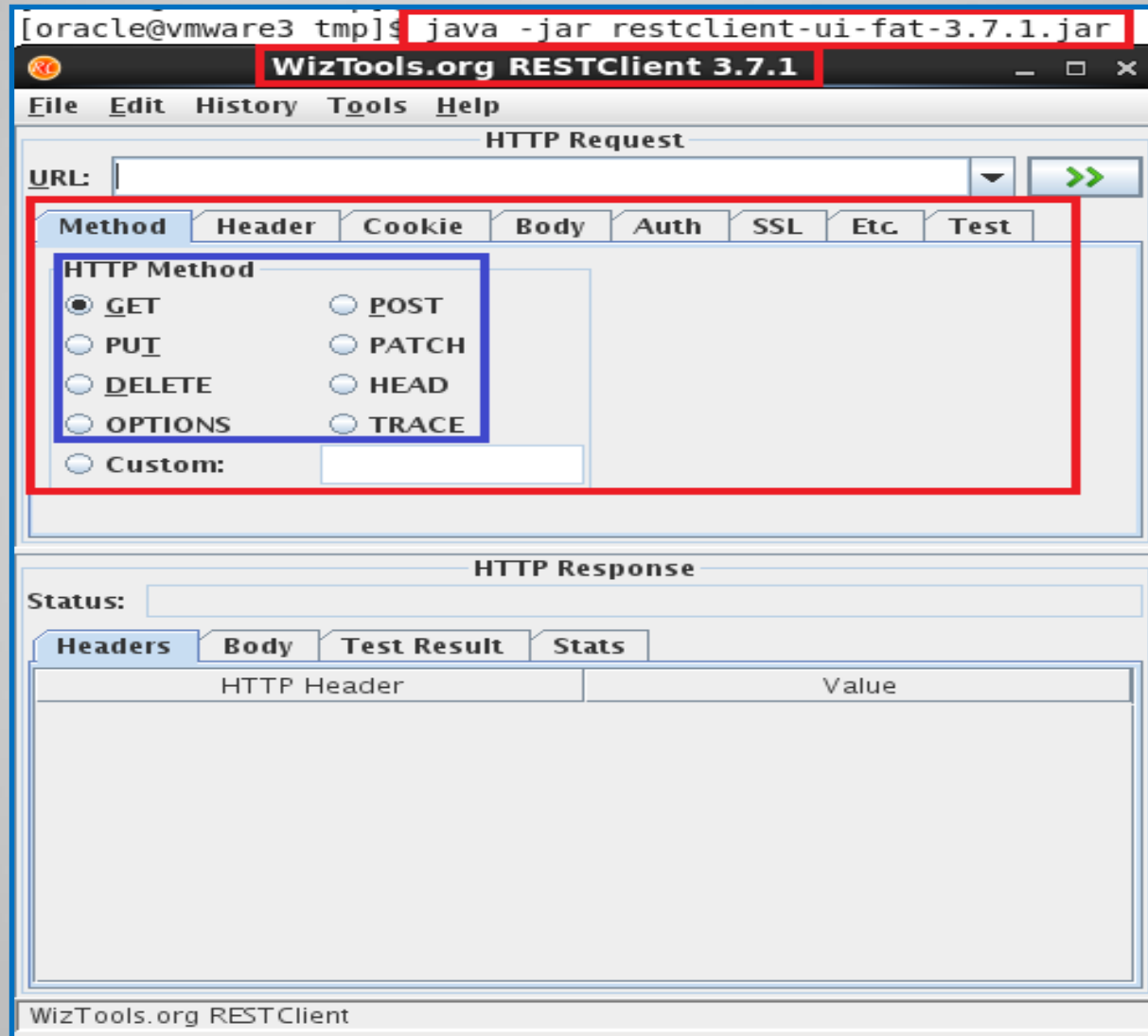
The screenshot displays the Oracle SQL Developer interface. On the left, the 'Verbindungen' (Connections) pane shows a tree structure with 'REST Data Services' expanded, revealing a 'job_count' module with a 'POST' method. The 'POST' method is highlighted with a red box, and its headers 'X-APEX-FORWARD' and 'X-APEX-STATUS-CODE' are visible. On the right, the 'SQL-Arbeitsblatt' (SQL Worksheet) pane shows the 'POST get_job_count' tab. The 'Arbeitsblatt' (Worksheet) tab is active, displaying a PL/SQL block. The 'insert into' statement is highlighted with a black box.

```
declare
  id t2_doag2019.item%type;
  status integer;
begin
  location := id;
  insert into t2_doag2019 values (sysdate,id,'D0AG2019');
  status := 201;
END;
```

URL: http://localhost:8080/ords/ordsdoag2019/job_count/.../id

Input: json-file

WizTools.org - RESTClient



REST Development Update/Delete

The screenshot displays the Oracle SQL Developer interface. On the left, the 'Verbindungen' (Connections) tree shows a project structure with 'REST Data Services' expanded, revealing a 'job_count' service. A context menu is open over 'job_count', with 'Handler hinzufügen' (Add Handler) selected. A sub-menu is visible, listing HTTP methods: GET, POST, PUT, and DELETE. The 'PUT' and 'DELETE' methods are highlighted with a red box. On the right, the 'POST get_job_count' handler is selected, and its 'Aktionen...' (Actions) tab is active. A table lists the actions for this handler, with the 'HTTP Method' and 'Source Type' columns highlighted by a red box.

ID	HTTP Method	Source Type
1 10108	GET	json/collection
2 10147	POST	plsql/block

REST – data dictionary

```
select OBJECT_NAME from all_objects where OBJECT_NAME like 'USER_ORDS%'
```

```
OBJECT_NAME
```

```
-----
```

```
USER_ORDS_APPROVALS
```

```
USER_ORDS_CLIENTS
```

```
USER_ORDS_CLIENT_PRIVILEGES
```

```
USER_ORDS_CLIENT_ROLES
```

```
USER_ORDS_ENABLED_OBJECTS
```

```
USER_ORDS_HANDLERS
```

```
USER_ORDS_MODULES
```

```
USER_ORDS_OBJECTS
```

```
...
```

```
USER_ORDS_ROLES
```

```
USER_ORDS_SCHEMAS
```

```
USER_ORDS_SERVICES
```

```
USER_ORDS_TEMPLATES
```

```
39 Zeilen gewählt.
```

REST – data dictionary

```
SELECT name, uri_prefix, uri_template, method, source_type, source
FROM
  user_ords_modules m, user_ords_templates t, user_ords_handlers h
WHERE   m.id = t.module_id
AND     t.id = h.template_id
ORDER BY 1,2,3,4;
```

NAME	URI_PREFIX	URI_TEMPLATE	METHOD	SOURCE_TYPE	SOURCE
----	-----	-----	-----	-----	-----
job_count	/job_count/	get_job_count	GET	json/collection	select job, count(*) from t_doag2019 group by job

REST – Konfigurationsfiles

```
[oracle@vmware3 ords]$ java -jar /ora18c/18.3.0/dbhome_1/ords/ords.war configdir
```

Aug 14, 2019 10:38:57 AM

INFORMATION: Der Wert für "config.dir" ist /ora18c/ords/ords

```
[oracle@vmware3 ords]$ ls -l /ora18c/ords/ords
```

```
drwxr-xr-x. 2 oracle oinstall 4096  5. Feb 2019  conf
-rw-r--r--. 1 oracle oinstall  408  5. Feb 2019  credentials
-rw-r--r--. 1 oracle oinstall  486  5. Feb 2019  defaults.xml
drwxr-xr-x. 2 oracle oinstall 4096  5. Feb 2019  standalone
```

```
[oracle@vmware3 ords]$ cat defaults.xml
```

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!DOCTYPE properties SYSTEM "http://java.sun.com/dtd/properties.dtd">
<properties>
<comment>Saved on Tue Feb 05 12:34:49 CET 2019</comment>
<entry key="db.hostname">localhost</entry>
<entry key="db.port">1521</entry>
<entry key="db.servicename">ORA18c_P1</entry>
<entry key="security.requestValidationFunction">www_flow_epg_include_modules.authorize</entry>
<entry key="security.validationFunctionType">plsql</entry>
</properties>
```

REST – Troubleshooting

Enabling Detailed Request Error Messages

defaults.xml

```
<entry key="debug.printDebugToScreen">true</entry>
```

Configuring Application Express Static Resources

```
[oracle@vmware3 ords]$ java -jar /ora18c/18.3.0/dbhome_1/ords/ords.war help static
```

```
java -jar ords.war static [--context-path] <location>
```

Ein Web Application Archive (WAR) generieren, um die statischen Oracle Application Express-Ressourcen zu bedienen

Optionen:

<code>--context-path</code>	Der Kontextpfad, unter dem WAR bereitgestellt wird, lautet standardmäßig: <code>/i</code>
-----------------------------	---

Argumente:

<code><location></code>	Das Verzeichnis, in dem die statischen Oracle Application Express-Ressourcen gespeichert werden
-------------------------------	---

Protect Resources

The screenshot illustrates the steps to protect resources in Oracle SQL Developer:

- Left Pane (Verbindungen):** The database tree shows the hierarchy. The 'Berechtigungen' (Privileges) folder is highlighted, and the 'Rollen' (Roles) folder is also highlighted.
- Right Pane (Berechtigung bearbeiten):** The 'Privilege bearbeiten' dialog is open. The 'Name' field is set to 'PRIV_DOAG2019'. The 'Beschreibung' (Description) field is set to 'Berechtigung fuer DOAG2019'. The 'Rollen' (Roles) list on the left includes 'OAuth2 Client Developer', 'RESTful Services', 'SODA Developer', 'Schema Administrator', and 'oracle.dbtools.autorest.any.schema'. The 'Gewählte Rollen' (Selected Roles) list on the right includes 'SQL Developer', 'oracle.dbtools.role.autorest.ORDSDOAG2019', and 'oracle.dbtools.role.autorest.ORDSDOAG2019.T_...'. The 'Module schützen' (Protect Module) button is highlighted.
- Bottom Pane (DBA):** The 'Module' list is empty, and the 'Geschützte Module' (Protected Modules) list contains 'job_count'.

OAuth 2.0 Client Application

- OAuth 2.0 ist Internet Standard Protokoll
- Applikation muss beim ORDS registriert werden

Sign in

localhost:8080/ords/ordsdoag2019/sign-in/?r=oauth%2Fclients%2F

ORACLE
Oracle REST Data Services

Einloggen in ORDS

Username
ords_dev

Password
●●●●●●●●

Sign in

OAuth 2.0 Client Application

OAuth Administration

localhost:8080/ords/ordsdoag2019/oauth/clients/

ORACLE REST Data Services

Home ords_dev

OAuth Clients

+ New Client

	DOAG2019	DOAG2019	 
---	----------	----------	---

Page 1 of 1 (1 of 1 items)   1  

OAuth 2.0 Client Application

The screenshot displays the Oracle REST Data Services (ORDS) OAuth Administration interface. The browser window title is 'OAuth Administration' and the address bar shows 'localhost:8080/ords/ordsdoag2019/oauth/clients/'. The page header includes the Oracle logo and 'REST Data Services'. The main content area is titled 'OAuth Clients' and shows a list of clients with 'DOAG2019' selected. The 'Edit Client' form is open, showing the following fields:

- Name ***: DOAG2019
- Description ***: DOAG2019
- Response Type**: TOKEN
- Allowed Origins**: http://localhost:8080/
- Support URI ***: http://localhost:8080/support
- Logo**: Choose a file
- Authorization**: AUTH_CODE
- Redirect URI ***: http://localhost:8080/redirect
- Support e-mail ***: support@company.de
- Required Privileges**: RESTful Service Editing
- Client Identifier**: O_XOtPoBHzILMVreJciVNg..
- Unique Value**: 76023404-e1ef-d607-2f5d-237645
- Authorization URI**: http://localhost:8080/ords/ordsdoag2019/oauth/auth?response_type=tok

At the bottom of the form, there are 'Save Client' and 'Cancel' buttons. The footer of the page includes links for 'About Oracle', 'Contact Us', and 'Legal Notice', along with a copyright notice for 2014, 2017 Oracle and/or its affiliates.

OAuth 2.0 Client Application

Client Identifier

```
curl -H 'Authorization: Bearer ..... ' -H "Accept: application/json"  
-X GET localhost:8080/ords/ordsdoag2019/job_count/get_job_count
```

```
{"items":[{"job":"CLERK","count(*)":4}, {"job":"SALESMAN","count(*)":4},  
{"job":"ANALYST","count(*)":2}, {"job":"MANAGER","count(*)":3}, {"job":"PRESIDENT","count(*)":1}],  
"hasMore":false,"limit":25,"offset":0,"count":5,"links":[{"rel":"self","href":  
"http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count"}, {"rel":"edit","href":  
"http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count"}, {"rel":"describedby","href":  
"http://localhost:8080/ords/ordsdoag2019/metadata-catalog/job_count/item"}, {"rel":"first","href":  
"http://localhost:8080/ords/ordsdoag2019/job_count/get_job_count"}]}
```

Client Identifier

The screenshot shows a 'RESTful Service Editing' dialog box with a red border around the 'Client Identifier' section. The 'Client Identifier' field contains the text '0_XotPoBHzILMVreJciVNg..'. Below it, the 'Unique Value' field contains '76023404-e1ef-d607-2f5d-237645'. To the right of the 'Unique Value' field is a blue button labeled 'Create New Value'. The 'Authorization URI' field contains 'http://localhost:8080/ords/ordsdoag2019/oauth/auth?response_type=tok'. At the bottom right of the dialog are two buttons: 'Save Client' and 'Cancel'. At the bottom left, there is a footer with links for 'About Oracle', 'Contact Us', and 'Legal Notice', and a copyright notice: 'Copyright © 2014, 2017 Oracle and/or its affiliates'.

Client Identifier
0_XotPoBHzILMVreJciVNg..

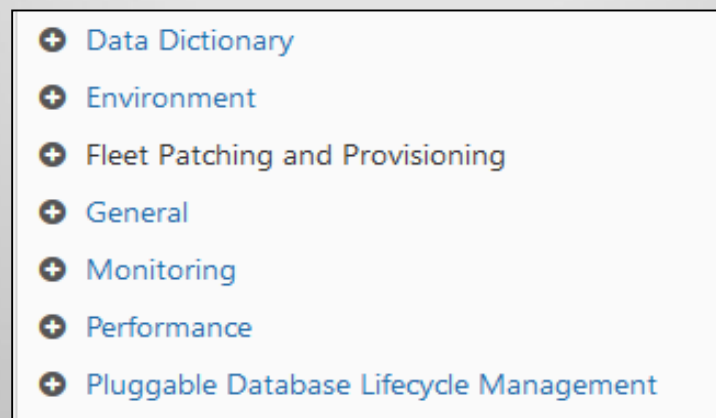
Unique Value
76023404-e1ef-d607-2f5d-237645

Authorization URI
http://localhost:8080/ords/ordsdoag2019/oauth/auth?response_type=tok

Save Client Cancel

Enabling ORDS Database API (19.1)

- Default: deaktiviert
- `java -jar ords.war set-property database.api.enabled true`
- `java -jar ords.war set-property jdbc.auth.enabled true`
- `GRANT PDB_DBA TO <schema>`
- `EXEC ORDS_ADMIN.ENABLE_SCHEMA(p_schema => ,<schema>');`
- `curl -i -X GET -u <username>:<password> -H <request-header>:<value> ...`
- **Beispiel:** `http://localhost:8080/ords/.../db-api/stable/database/storage/tablespaces`



Zusammenfassung

- ORDS ist eine Java-Applikation
- Erlaubt die Entwicklung von REST APIs
- Schwerpunktmäßiger Einsatz bei Maschine-zu-Maschine-Kommunikation
- Seit Oracle V12.1 fester Auslieferungs-Bestandteil
- Integration in den SQL Developer
- Keine Extra-Lizenzkosten erforderlich
- Unterstützung der gängigen Web-Server

Oracle REST Data Services

Danke für Ihre Aufmerksamkeit!

Fragen ...