

Gib mir deine Daten – Datenaustausch zwischen Oracle, PostgreSQL und MariaDB





DOAG-Datenbank-Konferenz
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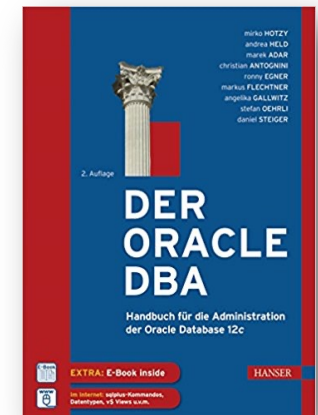
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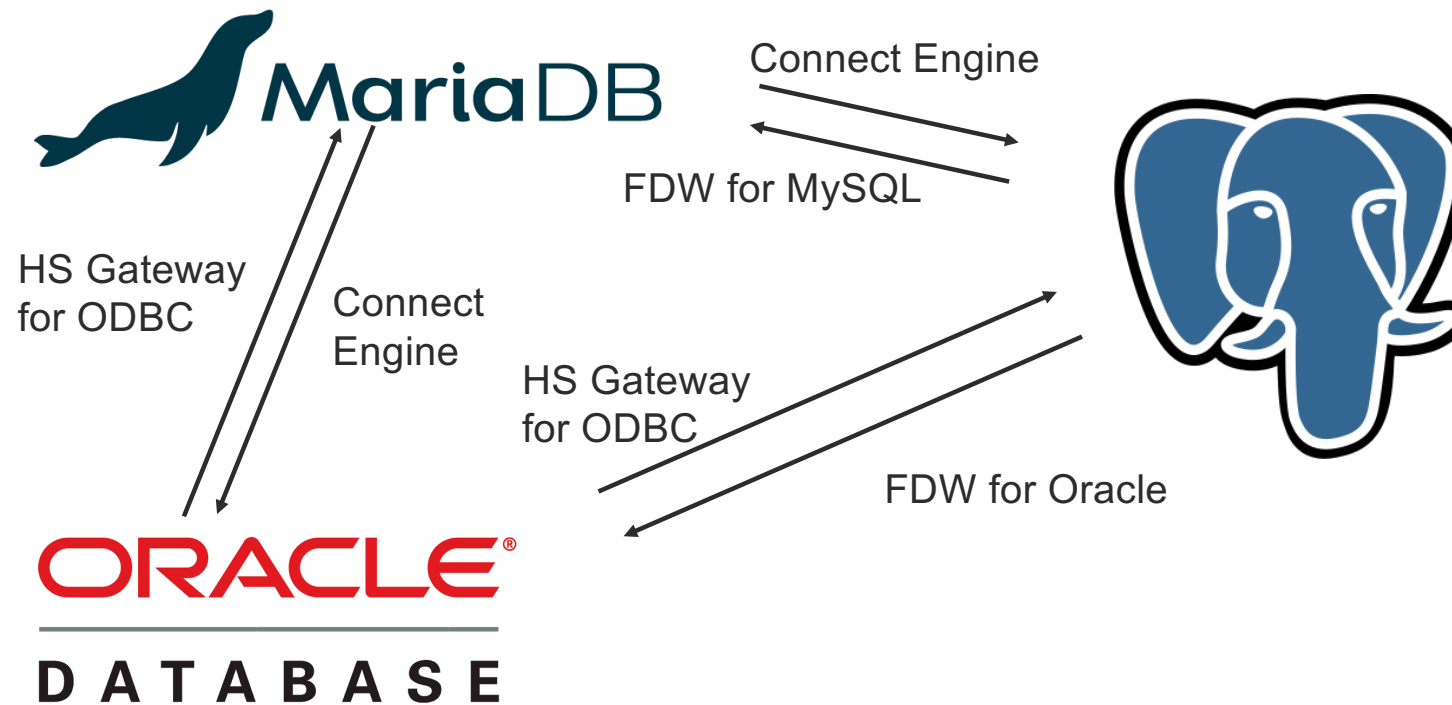
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Worum geht es?

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Technologien zum Zugriff auf andere Datenbanken

- PostgreSQL
 - Foreign Data Wrapper
- Oracle
 - ODBC Gateway
- MariaDB
 - Connect Engine

Agenda

- PostgreSQL Foreign Data Wrapper
- Oracle Heterogeneous Gateway für ODBC
- MariaDB Connect Engine
- Zusammenfassung & weitere Informationen

Foreign Data Wrapper

- Foreign Data Wrapper (FDW) dienen zum Zugriff von PostgreSQL heraus auf andere Datenquellen
- "Mitgeliefert" (contrib-Package) werden
 - FDW für PostgreSQL (postgres_fdw)
 - FDW für Datei-Zugriffe (file_fdw)
- Weitere Foreign Data Wrapper
 - PostgreSQL Extension Network <https://pgxn.org>
- Übersicht im PostgreSQL-Wiki: https://wiki.postgresql.org/wiki/Foreign_data_wrappers

PGXN
PostgreSQL Extension Network

users tags recent

Tag: “foreign data wrapper”

Distributions

couchdb_fdw 0.1.0	PostgreSQL SQL/MED FDW for CouchDB	2011-08-25		
cstore_fdw 1.7.0	Columnar Store for PostgreSQL	2020-02-18		
db2_fdw 5.0.0	PostgreSQL Data Wrapper to DB2 databases	2022-09-07		
file_textarray_fdw 1.0.1	Access to text files where each row is returned as an array of text	2012-03-08		
firebird_fdw 1.3.0	A PostgreSQL foreign data wrapper (FDW) for Firebird	2022-12-28		
foreign-keycloak-wrapper 1.0.2	PostgreSQL foreign data wrapper for keycloak's REST API	2020-04-14		
foreign_table_exposer 1.0.0	Expose foreign tables as a regular table	2015-12-18		
jdbc_fdw 1.0.0	jdbc FDW for PostgreSQL 9.1+	2013-04-20		
json_fdw 1.0.0	Foreign Data Wrapper for JSON files	2013-11-18		

Foreign Data Wrapper - Komponenten

Software	Foreign Data Wrapper
Extension	"create extension .."
"Foreign Server" – Verbindungsinformationen für die Datenquelle	"create foreign server .."
User-Mapping (mit welchem Benutzer verbindet sich der PostgreSQL-Benutzer mit der Datenquelle)	"create user mapping .."
Tabellen-Mapping der Tabelle aus dem Fremdsystem	"create foreign table ..."

Foreign Data Wrapper für Oracle

- Webseite: https://github.com/laurenz/oracle_fdw
- Aktuelle Version (Stand Januar 2023): Version 2.5.0 vom 28.10.2022
- Oracle-Client muss auf dem PostgreSQL-Server installiert sein
 - Instant-Client ist ausreichend
- Benötigt LLVM (früher "Low Level Virtual Machine")

Vorbereitungen

- Oracle Client installieren
- LLVM & weitere notwendige Komponenten installieren

```
# dnf -y install postgresql15-devel.x86_64 postgresql15-llvmjit.x86_64  
# dnf -y install gcc.x86_64 gcc-c++.x86_64  
# dnf -y install llvm-toolset-7.x86_64
```

Installation oracle_fdw

- Download der Software

```
# wget https://github.com/laurenz/oracle_fdw/archive/master.zip  
# unzip -uq master.zip
```

- Umgebung setzen

```
# export ORACLE_HOME=/opt/oracle/product/18c/dbhomeXE  
# export LD_LIBRARY_PATH=$ORACLE_HOME/lib
```

- Installation

```
# make  
# make install
```

Vorbereitungen in PostgreSQL (1) – Server-Konfiguration

- Die Oracle-Client-Library muss im Suchpfad sein, wenn der PostgreSQL-Cluster gestartet wird
- Variante 1 (systemctl / override.conf)

```
[Service]
Environment=PGDATA=/pgdata/Pg15
Environment=ORACLE_HOME=/opt/oracle/product/18c/dbhomeXE
Environment=LD_LIBRARY_PATH=/opt/oracle/product/18c/dbhomeXE/lib
```

- Variante 2 (start via Shell / pg_ctl)

```
$ export ORACLE_HOME=/opt/oracle/product/18c/dbhomeXE
$ export LD_LIBRARY_PATH=/opt/oracle/product/18c/dbhomeXE/lib

$ pg_ctl start ...
```

Vorbereitungen in PostgreSQL (2) – Erweiterung & Foreign Server

- Erweiterung anlegen

```
postgres# create extension oracle_fdw;  
CREATE EXTENSION
```

- Foreign Server anlegen

```
postgres# create server oraclexe foreign data wrapper oracle_fdw  
2 > options (dbserver '//localhost:1521/XEPDB1');  
CREATE SERVER
```

- Nutzung in PostgreSQL erlauben

```
postgres# grant usage on foreign server oraclexe to public;  
GRANT
```

Vorbereitungen in PostgreSQL (3) – User Mapping & Foreign Table

- User Mapping anlegen

```
postgres# create user mapping for postgres server oraclexe
 2 > options (user 'scott', password 'tiger');
CREATE USER MAPPING
```

- Foreign Table anlegen

```
postgres# CREATE FOREIGN TABLE dept (
 1 > deptno          integer          NOT NULL,
 2 > dname character varying(30),
 3 > loc character varying(13),
 4 > ) SERVER oraclexe OPTIONS (schema 'SCOTT', table 'DEPT');
CREATE FOREIGN TABLE
postgres# select count(*) from dept;
 count
-----
      4
(1 row)
```

**GROSSSCHRIFT
ist wichtig**

DML-Test

- 1. Versuch

```
postgres# update dept set loc='PADERBORN' where deptno=10;  
ERROR:  HV00L: no primary key column specified for foreign Oracle table  
DETAIL:  For UPDATE or DELETE, at least one foreign table column must be marked  
as primary key column.  
HINT:  Set the option "key" on the columns that belong to the primary key.
```

- Korrektur

```
postgres# alter foreign table dept alter "deptno" options (ADD key 'true');  
ALTER FOREIGN TABLE
```

- 2. Versuch

```
postgres# update dept set loc='PADERBORN' where deptno=10;  
UPDATE 1
```


Einfacher: Schema-Import

```
postgres# IMPORT FOREIGN SCHEMA "SCOTT"  
2 > FROM SERVER oraclexe  
3 > INTO public  
4 > OPTIONS (case 'lower');  
IMPORT FOREIGN SCHEMA  
  
postgres# select count(*) from public.emp;  
count  
-----  
14  
(1 row)  
  
postgres# update public.emp set sal=5100 where empno=7839;  
UPDATE 1
```

- Die Optionen "LIMIT TO" bzw. "EXCEPT" erlauben die Beschränkung auf bestimmte Tabellen oder den Ausschluss einzelner Tabellen

Foreign Data Wrapper for MySQL/MariaDB

- Verfügbar im PostgreSQL Repository
- Aktuelle Version: 2.9 (Dezember 2022)
- Installation via rpm:

```
root# yum install -y mysql_fdw_15 --nobest --allowrasing
```

- Das Package erwartet die MySQL-Binaries, daher muss bei der Verwendung von MariaDB mit den Optionen "--nobest" und "--allowrasing" gearbeitet werden

Foreign Data Wrapper for MySQL/MariaDB – Konfiguration

1. Erweiterung anlegen

```
postgres# create extension mysql_fdw;  
CREATE EXTENSION
```

2. Foreign Server anlegen

```
postgres# create server mariadb foreign data wrapper mysql_fdw options  
2> (host 'localhost', port '3306');  
CREATE SERVER
```

3. User Mapping anlegen

```
postgres# create user mapping for public server mariadb options  
2> (username 'demo', password 'geheim');  
CREATE USER MAPPING
```

4. Table Mapping

```
postgres# CREATE FOREIGN TABLE public.city
> (id integer,
> name char(35),
> countrycode char(3),
> district char(20),
> population integer
> )
> SERVER mariadb
> OPTIONS (dbname 'world', table_name 'city');
```

```
postgres# select count(*) from public.city;
 count
-----
  4079
(1 row)
```

Meta-Befehle rund um Foreign Data Wrapper

- Meta-Befehle

```
\dE[S+] [PATTERN]      list foreign tables
\dES[+] [PATTERN]      list foreign servers
\dEU[+] [PATTERN]      list user mappings
\dEW[+] [PATTERN]      list foreign-data wrappers
```

- Beispiel

```
postgres# \dE
          List of relations
 Schema | Name      | Type          | Owner
-----+-----+-----+-----
 public | bonus    | foreign table | postgres
 public | dept     | foreign table | postgres
 public | emp      | foreign table | postgres
 public | salgrade | foreign table | postgres
(4 rows)
```

Views im System Catalog

- pg_foreign_data_wrapper
- pg_foreign_server
- pg_foreign_table
- pg_user_mapping

```
postgres# select * from pg_user_mapping;
 oid | umuser | umserver |          umoptions
-----+-----+-----+-----
 47043 |    10 |   47038 | {user=scott,password=tiger}
(1 row)

postgres# select srvname,srvoptions from pg_foreign_server;
 srvname |          srvoptions
-----+-----
 oraclexe | {dbserver=//localhost:1521/XEPDB1}
(1 row)
```

Agenda

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- PostgreSQL Foreign Data Wrapper
- Oracle Heterogeneous Gateway für ODBC
- MariaDB Connect Engine
- Zusammenfassung & weitere Informationen

Oracle Heterogeneous Services (HS)

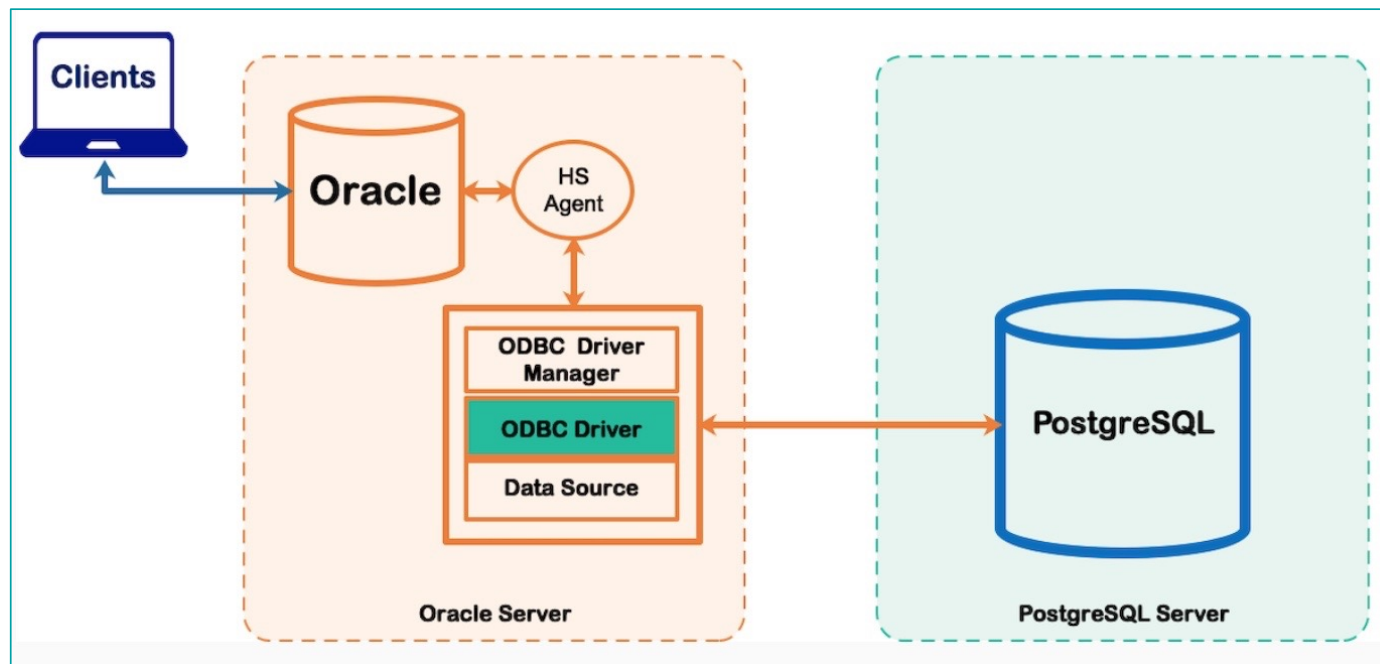
- Unter dem Namen "Oracle Heterogeneous Services (HS)" platziert Oracle die Gateways zu anderen Datenbanken bzw. Systemen
- Beispiele:
 - APPC
 - DRDA (Distributed Relational Database Architecture, DB2)
 - Informix
 - ODBC
 - SQL Server
 - Sybase
 - Teradata
 - WebSphere MQ

- Oracle Database 21c - Licensing Information

Feature / Option / Pack	X E	SE 2	E E	EE - ES	DBCS SE	DBCS EE	DBCS EE-HP	DBCS EE-EP	ExaCS /CC	Notes
Database Gateways	N	Y	Y	Y	Y	Y	Y	Y	Y	<p>Database Gateway for ODBC is included in all offerings.</p> <p>All other Database Gateway products are available for all offerings, but require a separate product license.</p>

Oracle Database Gateway for ODBC	Oracle Database Gateway for ODBC can be installed and used on a machine different from the machine where the Oracle Database is installed and used. It is not necessary to obtain a separate license for the machine running Oracle Gateway for ODBC.
----------------------------------	---

ODBC-Gateway zu PostgreSQL - Architektur



Quelle: <https://www.enterprisedb.com/postgres-tutorials/accessing-postgresql-databases-using-psqlodbc-oracle>

Installation (1) – Software-Komponenten

1. Zusätzliche Software-Komponenten installieren

```
# ### Oracle Server
# yum install -y unixODBC unixODBC-devel

# ### PostgreSQL-Server
# yum install -y postgresql15-odbc
```

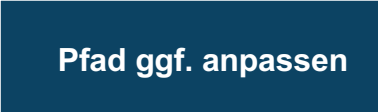
- Informationen zum PostgreSQL-ODBC-Driver: <https://odbc.postgresql.org/>
- Wo liegen die Konfigurationsdateien (ODBC-Konfiguration) auf dem Oracle-Server?

```
$ odbcinst -j
unixODBC 2.3.1
DRIVERS.....: /etc/odbcinst.ini
SYSTEM DATA SOURCES: /etc/odbc.ini
FILE DATA SOURCES..: /etc/ODBCDataSources
USER DATA SOURCES...: /home/oracle/.odbc.ini
SQLULEN Size.....: 8
SQLLEN Size.....: 8
SQLSETPOSIROW Size.: 8
```

Installation (2) – odbcinst.ini

2. ODBC-Konfiguration (/etc/odbcinst.ini)

```
[PostgreSQL]
Description      = ODBC for PostgreSQL
Driver           = /usr/pgsql-15/lib/psqlodbcw.so
Setup            = /usr/lib64/libodbcpsqlS.so
Driver64         = /usr/pgsql-15/lib/psqlodbcw.so
Setup64          = /usr/lib64/libodbcpsqlS.so
FileUsage        = 1
```



Installation (3) – Datenquelle in odbc.ini definieren

3. ODBC-Datenquelle definieren (/etc/odbc.ini oder /home/oracle/.odbc.ini)

```
[pg]
Database      = scott_db
Description   = Connection to PostgreSQL Cluster PG15
Driver        = PostgreSQL
Servername    = localhost
Port          = 5432
Username      = postgres
Password      = manager
```



- Übersicht über alle Konfigurationsparameter: <https://odbc.postgresql.org/docs/config.html>
- User & Password sind nicht erforderlich → nach erfolgreichem Test entfernen

Installation (4) – Datenquelle testen

4. Testen der ODBC-Datenquelle

```
# isql -v pg
+-----+
| Connected! |
|           |
| sql-statement |
| help [tablename] |
| quit |
|           |
+-----+
SQL> quit
```

- "-v " (verbose" für detailliertere Fehlermeldungen
- Nach dem Test sollten User und Password aus der odbc.ini entfernt werden

Installation (5) – Gateway: init-Datei

5. Init-Datei für das Gateway definieren

```
$ cat $ORACLE_HOME/hs/admin/initpg.ora  
  
HS_FDS_CONNECT_INFO = pg  
HS_FDS_TRACE_LEVEL = ON  
HS_FDS_SHAREABLE_NAME = /usr/pgsql-15/lib/psqlodbcw.so  
HS_LANGUAGE = AMERICAN_AMERICA.WE8ISO8859P15  
set ODBCINI=/etc/odbc.ini
```

- Im Verzeichnis \$ORACLE_HOME/hs/admin liegt auch eine Beispieldatei initdg4odbc.ora
- In jedem Fall AMERICAN_AMERICA.WE8ISO8859P15 als Sprache verwenden, damit Fehlermeldungen des unixODBC angezeigt werden! – siehe auch MOS-Note 756186.1

Installation (6) – Gateway-Listener

6. Listener für das Gateway definieren (listener.ora)

```
$ cat $ORACLE_HOME/network/admin/listener.ora

LISTENERPG=
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP) (HOST = dedekind.markusdba.mac) (PORT = 1522))
      (ADDRESS = (PROTOCOL = IPC) (KEY = EXTPROC1522))
    )
  )

SID_LIST_LISTENERPG=
(SID_LIST=(SID_DESC=(SID_NAME=pg) (ORACLE_HOME=/opt/oracle/product/18c/dbhomeXE)
(PROGRAM=dg4odbc)))
```

- Alternativ zum separaten Listener kann man auch den normalen Listener "LISTENER" verwenden und das Gateway mittels SID_LIST_LISTENER einbinden

Installation (7) – Gateway-Listener starten

7. Listener für das Gateway starten

```
$ lsnrctl start listenerpg

LSNRCTL for Linux: Version 18.0.0.0.0 - Production on 19-JAN-2023 22:25:03
Copyright (c) 1991, 2018, Oracle. All rights reserved.
Starting /opt/oracle/product/18c/dbhomeXE/bin/tnslsnr: please wait...

TNSLSNR for Linux: Version 18.0.0.0.0 - Production
System parameter file is
/opt/oracle/product/18c/dbhomeXE/network/admin/listener.ora
Log messages written to
/opt/oracle/diag/tnslsnr/dedekind/listenerpg/alert/log.xml
Listening Endpoints Summary...
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp) (HOST=dedekind.markusdba.mac) (PORT=1522)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc) (KEY=EXTPROC1522)))
Services Summary...
Service "pg" has 1 instance(s).
  Instance "pg", status UNKNOWN, has 1 handler(s) for this service...
The command completed successfully
```

Installation (8) – tnsnames.ora-Eintrag definieren & testen

8. Tnsnames.ora-Eintrag definieren und testen

```
$ cat $ORACLE_HOME/network/admin/tnsnames.ora
[...]  
pg=  
  (DESCRIPTION=  
    (ADDRESS=  
      (PROTOCOL=TCP) (HOST = dedekind.markusdba.mac) (PORT = 1522))  
    (CONNECT_DATA= (SID=pg)) (HS=OK)  
  )  
  
$ tnsping pg  
TNS Ping Utility for Linux: Version 18.0.0.0.0 - Production on 19-JAN-2023  
10:35:19  
[...]  
Used TNSNAMES adapter to resolve the alias  
Attempting to contact (DESCRIPTION= (ADDRESS= (PROTOCOL=TCP) (HOST =  
dedekind.markusdba.mac) (PORT = 1522)) (CONNECT_DATA= (SID=pg)) (HS=OK))  
OK (10 msec)
```

Datenbank-Link anlegen

- Datenbank-Link anlegen und testen

```
SQL> create database link PG connect to "scott" identified by "tiger"
2  using 'PG';
Database link created.

SQL> select * from "scott"."emp"@PG;
select * from "scott"."emp"@PG
                *

ERROR at line 1:
ORA-28500: connection from ORACLE to a non-Oracle system returned this message:
[unixODBC]SCRAM authentication requires libpq version 10 or above
{08001,NativeErr = 101}
ORA-02063: preceding 3 lines from PG
```

[unixODBC]SCRAM authentication requires libpq version 10 or above

- Ursache: unixodbc bringt anscheinend eine alte PostgreSQL-Client-Library libpq.so mit (Centos 7)
- Lösung:

```
# pwd
/usr/lib64

# ls -ltr libpq*
-rwxr-xr-x. 1 root root 197544 Jun 24 2022 libpq.so.5.5
lrwxrwxrwx. 1 root root      12 Jan  8 11:02 libpq.so.5 -> libpq.so.5.5

# rm libpq.so.5

# ln -s /usr/pgsql-15/lib/libpq.so /usr/lib64/libpq.so.5

# ls -al libpq*
lrwxrwxrwx. 1 root root      26 Jan 19 22:21 libpq.so.5 -> /usr/pgsql-15/lib/libpq.so
-rwxr-xr-x. 1 root root 197544 Jun 24 2022 libpq.so.5.5
```

Der Übeltäter

```
SQL> select count(*) from "scott"."emp"@PG;
```

```
  COUNT (*)  
-----  
          14
```

- Achtung:
 - Bei PostgreSQL sind die Objekt-Namen alle in **kleinschrift**
→ daher **Anführungszeichen (' " ') verwenden**
 - → ggf. auf Oracle-Ebene mit **Views** arbeiten, bei denen die PostgreSQL-Namen in **GROSSSCHRIFT** umgewandelt werden

Beispiel für DML

```
SQL> select "salary" from "scott"."emp"@pg where "name"='KING' ;
      salary
-----
      5000

SQL> update "scott"."emp"@pg set "salary"="salary"+100 where "name"='KING' ;
1 row updated.

SQL> commit;
Commit complete.

SQL> select "salary" from "scott"."emp"@pg where "name"='KING' ;
      salary
-----
      5100
```

Achtung bei den Datentypen

```
SQL> select "rolname","rolcanlogin" from "pg_roles"@pg;
```

rolname	rolcanlogin
[...]	
pg_checkpoint	0
postgres	1
scott	1
monitor_system_stats	0

0 = false
1 = true

ODBC-Gateway für MySQL/MariaDB (1)

- Gleiches Prinzip wie bei der Verbindung Oracle → PostgreSQL
- Erforderliche Pakete: unixODBC, unixODBC-devel und mariadb-connector-odbc
- /etc/odbc.ini

```
[mariadb]
Database      = world
Description   = Connection to MariaDB
Driver        = MariaDB
Servername    = localhost
Port          = 3306
UID           = fdw_user
PWD           = geheim
```

- Testen mit "isql -v mariadb"

ODBC-Gateway für MySQL/MariaDB (2) – init-Datei für das Gateway

- Init-Datei für das ODBC-Gateway - \$ORACLE_HOME/hs/admin/initmariadb.ora

```
HS_FDS_CONNECT_INFO = pg
HS_FDS_TRACE_LEVEL = ON
HS_FDS_SHAREABLE_NAME = /usr/lib64/libmaodbc.so
HS_LANGUAGE = AMERICAN_AMERICA.WE8ISO8859P15
set ODBCINI=/etc/odbc.ini
```

Aus
/etc/odbcinst.ini

- Eintrag in der listener.ora:

```
$ cat $ORACLE_HOME/network/admin/listener.ora

LISTENERMARIADB=
  (DESCRIPTION_LIST =
    (DESCRIPTION =
      (ADDRESS = (PROTOCOL = TCP) (HOST = 127.0.0.1) (PORT = 1523))
      (ADDRESS = (PROTOCOL = IPC) (KEY = EXTPROC1523))
    )
  )

SID_LIST_LISTENERMARIADB=
(SID_LIST=(SID_DESC=(SID_NAME=mariadb) (ORACLE_HOME=/opt/oracle/product/23c/dbhomeFree)
(PROGRAM=dg4odbc)))
```

- Listener starten ("lsnrctl start listenermariadb")

ODBC-Gateway für MySQL/MariaDB (4) - tnsnames.ora

- Eintrag in der tnsnames.ora

```
$ cat $ORACLE_HOME/network/admin/tnsnames.ora
[...]
mariadb=
  (DESCRIPTION=
    (ADDRESS=
      (PROTOCOL=TCP) (HOST = 127.0.0.1) (PORT = 1523))
    (CONNECT_DATA= (SID=mariadb)) (HS=OK)
  )
$ tns ping mariadb
TNS Ping Utility for Linux: Version 23.0.0.0.0 - Developer-Release on 15-MAY-2023
14:43:40
Copyright (c) 1997, 2023, Oracle. All rights reserved.
Used parameter files:
/opt/oracle/product/23c/dbhomeFree/network/admin/sqlnet.ora
Used TNSNAMES adapter to resolve the alias
Attempting to contact (DESCRIPTION= (ADDRESS= (PROTOCOL=TCP) (HOST =
127.0.0.1) (PORT = 1523)) (CONNECT_DATA= (SID=mariadb)) (HS=OK))
OK (0 msec)
```

- Datenbank-Link anlegen und testen

```
SQL> create database link mariadb connect to "fdw_user" identified by "geheim"
      2 using 'mariadb';
Database link created.

SQL> select count(*) from "country"@"mariadb";

COUNT (*)
-----
          239
```

- Wie bei PostgreSQL: Namen in Anführungszeichen setzen

Agenda

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- PostgreSQL Foreign Data Wrapper
- Oracle Heterogeneous Gateway für ODBC
- MariaDB Connect Engine
- Zusammenfassung & weitere Informationen

MariaDB Connect Engine

- Zugriff auf externe Datenquellen von MariaDB aus
- Gemäß dem MED-Standard ("Management of External Data")
- Datenquellen
 - ODBC
 - JDBC
 - MongoDB
 - CSV, XML
 - ...
- Dokumentation:
 - <https://mariadb.com/kb/en/introduction-to-the-connect-engine/>
- Bei MySQL gibt es nichts Vergleichbares

MariaDB Connect Engine - Installation

- RPM-Paket installieren

```
dnf install -y MariaDB-connect-engine unixODBC
```

- Engine in der DB installieren

```
MariaDB [(none)]> install soname 'ha_connect.so';  
Query OK, 0 rows affected (0.001 sec)
```

MariaDB Connect Engine- vorhandene Engines

```
MariaDB [(none)]> show engines;
```

Engine	Support	Comment
CSV	YES	Stores tables as CSV files
MRG_MyISAM	YES	Collection of identical MyISAM tables
MEMORY	YES	Hash based, stored in memory, useful for temporary tables
Aria	YES	Crash-safe tables with MyISAM heritage. Used for internal temporary tables
MyISAM	YES	Non-transactional engine with good performance and small data footprint
CONNECT	YES	Management of External Data (SQL/NOSQL/MED), including Rest query results
SEQUENCE	YES	Generated tables filled with sequential values
InnoDB	DEFAULT	Supports transactions, row-level locking, foreign keys and encryption ...
PERFORMANCE_SCHEMA	YES	Performance Schema

MariaDB Connect Engine - ODBC-Verbindung konfigurieren

- Analog zu Oracle-ODBC-Gateway
 - `/etc/odbc.ini`
 - Testen mit `isql`

MariaDB Connect Engine - Verbindung zu PostgreSQL

```
MariaDB [(none)]> use world;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
MariaDB [world]> create table emp_pg_remote engine=connect table_type=ODBC
tabname='emp' dbschema='scott' connection='dsn=pg';
Query OK, 0 rows affected (0.048 sec)
```

ODBC-Quelle

```
MariaDB [world]> select * from emp_pg_remote;
+-----+-----+-----+-----+-----+-----+-----+
| empno | name  | job      | manager | hiredate  | salary  | comm   | deptno |
+-----+-----+-----+-----+-----+-----+-----+
| 7839 | KING  | PRESIDENT | NULL    | 1981-11-17 | 5000.00 | NULL   | 10     |
| 7566 | JONES | MANAGER   | 7839    | 1981-04-02 | 2975.00 | NULL   | 20     |
| 7788 | SCOTT | ANALYST   | 7566    | 1982-12-09 | 3000.00 | NULL   | 20     |
| 7876 | ADAMS | CLERK     | 7788    | 1983-01-12 | 1100.00 | NULL   | 20     |
[...]
```

MariaDB Connect Engine - Verbindung zu Oracle

- /etc/odbcinst.ini

```
[Oracle]
Description=Oracle Driver
Driver=/opt/oracle/product/23c/dbhomeFree/lib/libsqora.so.23.1
```

- Instant-Client reicht aus

- /etc/odbc.ini

```
[scott]
Driver = Oracle
UserID = scott
Password = tiger
ServerName = //localhost:1521/XEPDB1
```

- Test mit isql

MariaDB Connect Engine - Verbindung zu Oracle

- Tabelle anlegen

```
MariaDB> create table emp_remote engine=connect table_type=ODBC tabname='EMP'  
dbschema='SCOTT' connection='dsn=scott';  
Query OK, 0 rows affected (3.509 sec)
```

Agenda

- PostgreSQL Foreign Data Wrapper
- Oracle Heterogeneous Gateway für ODBC
- MariaDB Connect Engine
- Zusammenfassung & weitere Informationen

Zusammenfassung

- Datenaustausch zwischen allen drei beteiligten Datenbanken ist möglich
- Installation insgesamt "problemarm"
- Achtung bei der Standard-Schreibweise der Objektnamen:
 - Oracle: GROSS
 - MySQL/MariaDB, PostgreSQL: klein

Weitere Informationen – Oracle ODBC-Gateway

- Oracle Database 21c: Database Heterogeneous Connectivity User's Guide
<https://docs.oracle.com/en/database/oracle/oracle-database/21/heter/index.html>
- Oracle Database 21c: Oracle® Database Gateway for ODBC - User's Guide
<https://docs.oracle.com/en/database/oracle/oracle-database/21/odbcu/index.html>
- Accessing PostgreSQL databases using psqLODBC in Oracle:
<https://www.enterprisedb.com/postgres-tutorials/accessing-postgresql-databases-using-psqlodbc-oracle>
- MOS-Notes
 - How to Resolve Common Errors Encountered while using Database Gateways (DG4IFMX, Dg4MSQL, DG4SYBS), DG4ODBC or Generic Connectivity (Doc ID 234517.1)
 - ORA-28545 If PROGRAM=dg4odbc.exe Is Specified In The Gateway LISTENER.ORA (Doc ID 1323387.1)
 - How to Configure DG4ODBC on 64bit Unix OS (Linux, Solaris, AIX, HP-UX Itanium) to Connect to Non-Oracle Databases Post Install (Doc ID 561033.1)
 - Error Ora-28500 and Sqlstate I or Displays a Square Bracket - [- Issuing Selects From a Unicode Oracle RDBMS With Dg4odbc To Non-Oracle Databases Using the UnixODBC Driver Manager (Doc ID 756186.1)

Weitere Informationen – PostgreSQL Foreign Data Wrappers

- Übersicht im PostgreSQL-Wiki: https://wiki.postgresql.org/wiki/Foreign_data_wrappers
- FDW for Oracle: https://github.com/laurenz/oracle_fdw
- FDW for MySQL/MariaDB: https://github.com/EnterpriseDB/mysql_fdw
- PostgreSQL Accessing MySQL as a Data Source Using mysql_fdw
https://www.percona.com/blog/2018/08/24/postgresql-accessing-mysql-as-a-data-source-using-mysql_fdw/

Weitere Informationen – MariaDB Connect Engine

- CONNECT - MariaDB Knowledge Base
<https://mariadb.com/kb/en/connect/>
- Installing the CONNECT Storage Engine - MariaDB Knowledge Base
<https://mariadb.com › kb › en › installing-the-connect-storage-engine>
- Die MariaDB Connect Engine: Bitte bleiben Sie dran, die Verbindung wird hergestellt.
<https://blog.ordix.de/die-mariadb-connect-engine-bitte-bleiben-sie-dran-die-verbinding-wird-hergestellt>

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**Vielen Dank für
Ihre Aufmerksamkeit**

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