California State University, San Bernardino School of Computer Science & Engineering CSE572 SUMMER 2019 -Database Systems

LAB 02 – SQL Developer and HR Sample Schema, Aggregating Data Using Group Functions

In this lab, you work with Oracle tables using basic SQL. For the better user experiences, Oracle SQL Developer can help users navigate and develop complex queries. The SQL Developer is using native SQL*Net connections to establish communication in between the client (your workstation) and servers. In enterprise operation environment, database connections are protected by firewalls. Clients cannot establish direct accesses to servers without VPN tunneling. As part of the exercises, you will learn how to establish a simple VPN tunnel using ssh.

SSH tunneling is a method of transporting arbitrary networking data over an encrypted SSH connection. It can be used to add encryption to legacy applications. It can also be used to implement VPNs (Virtual Private Networks) and access intranet services across firewalls. The secure connection over the untrusted network is established between an SSH client and an SSH server. This SSH connection is encrypted, protects confidentiality and integrity, and authenticates communicating parties.

The SSH connection is used by the application to connect to the application server. With tunneling enabled, the application contacts to a port on the local host that the SSH client listens on. The SSH client then forwards the application over its encrypted tunnel to the server. The server then connects to the actual application server - usually on the same machine or in the same data center as the SSH server. The application communication is thus secured, without having to modify the application or end user workflows.

To establish the SSH tunnel, depend on what the operating systems using on your workstation,

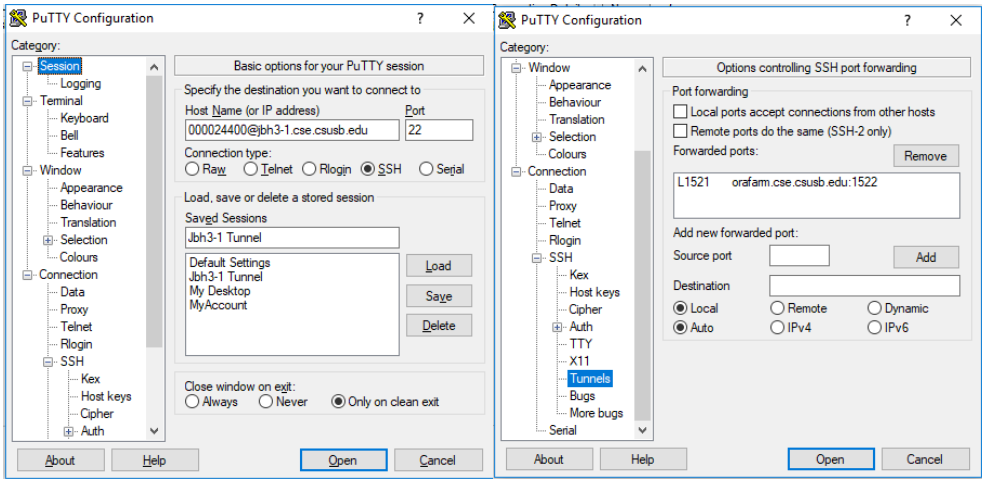
For Linux and Mac, you simply establish the SSH connection using the terminal with in the operating system shell.

In your terminal, you can enter

$ ssh -N -L localhost:1521:orafarm.cse.csusb.edu:1522 <CoyoteID>@jbh3-1.cse.csusb.edu

-N means Do not execute a remote command and -L means the port forwarding.

If you are running on Windows, you can use Putty to configure the SSH tunnel



Once you established the SSH tunnel, you can use the SQL Developer as inside of the enterprise network.

SQL Developer is a graphical tool that enables you to browse, create, edit, and delete (drop) database objects; run SQL statements and scripts; edit and debug PL/SQL code; unload (export) and load (import) data; migrate third-party databases to Oracle; and view metadata and data. The instructions in this guide use SQL Developer for getting started with database development.

To install and start SQL Developer:

1. Go to the Oracle Technology Network page for SQL Developer at **http://www.oracle.com/technetwork/developer-tools/sql-developer/**

Note:

If a Windows 64-bit SQL Developer kit that includes JDK 8 is available, you can download and install that on a Windows 64-bit system, and SQL Developer will use the embedded JDK that is provided with that kit.

However, if you need or simply want to use a JDK on your Windows 64-bit system, you can install the JDK (if it is not already installed) and the Windows 32/64-bit SQL Developer kit, and SQL Developer will use the JDK that is installed on your system.

2. If you do not need or want to install a suitable Java Development Kit (JDK 8 or later), go to step 3. Otherwise, download and install the JDK as follows:

a. On the SQL Developer Downloads page (**http://www.oracle.com/technetwork/developer-tools/sql-developer/downloads/index.html**), click the **Download** link next to **SQL Developer requires JDK 8 or above**.

b. On the Java SE Development Kit 8 Downloads page (https://www.oracle.com/technetwork/java/javase/downloads/index.html), in the

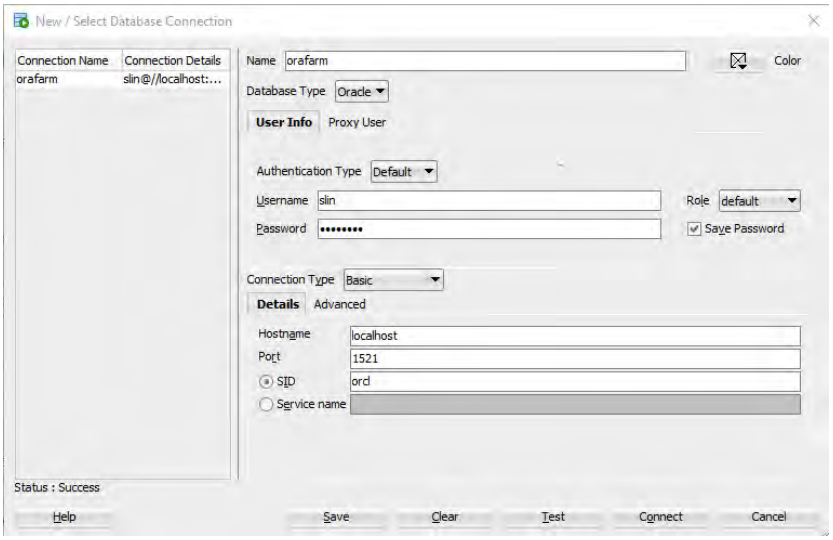
table of Java SE Development Kits, accept the Oracle Binary Code License Agreement for Java SE.

c. Click the link for the download that you need (for example, the *Windows x64* link for a Windows 64-bit system).
d. Save the file anywhere on your system (such as a "temp" folder).
e. Install the JDK (for example, on Windows, double-click the .exe file name and follow the displayed instructions).

3. On the Oracle Technology Network page for SQL Developer at **http://www.oracle.com/technetwork/developer-tools/sql-developer/** , click the **Downloads** tab (next to Overview).
4. Read and accept the license agreement.
5. Follow the instructions for downloading and installing SQL Developer.

The installation itself is simple. For example, on a Windows PC you can unzip the downloaded file into **C:**, which will create **C:\sqldeveloper** with files and folders in and under it.

After complete the installation, you can launch the SQL Developer and add a new connection as following,



In Oracle SQL Developer, you can work on the exercise focuses on HR, the sample human resources database you activated above. Before starting the exercise, explore the HR database schema, using these helpful hints as needed.

- Study the HR database schema linked here: Database Sample Schemas (look under "Schema Diagrams").
- List all of HR user's tables by logging in as the hr user and running SELECT table_name FROM dba_tables WHERE owner = 'HR' and SELECT view_name FROM dba_views WHERE owner= 'HR' ; .
- Based on results of previous queries, list tables and views included in HR schema are
  - JOBS
  - EMPLOYEES

- JOB_BRADES
- COUNTRIES
- LOCATIONS
- DEPARTMENTS
- JOB_HOSTORY
- REGIONS
- EMP_DETAILS_VIEW

- Display a detailed table schema using DESCRIBE table name;

START of LAB 02 Exercise
The exercises below must be finished by Tuesday, August 20.

Create a file to record SQL queries, results and explanations on following questions. Upon the completion of lab works, convert the file to LAB02.PDF and submit to blackboard.

1 List all the rows of the departments table.
2 Find the number of employees in the database (hint: use the COUNT() aggregate function for this);
   a. List the employees who:
   b. have a salary greater than 15000,
   c. were hired between January 1, 2002 and January 1, 2005,
3 have a phone number that doesn't start with 515
4 List the names of the employees who are in the finance department. Try to format the names as "firstname lastname" using concatenation (i.e., ||) and order them alphabetically.
5 List the city, state and country name for all locations in the Asian region.
6 List the locations that have no state or province specified in the database.
7 Create a query to display the highest, lowest, sum and average salary of all employees. Label the columns Maximum, Minimum, Sum and Average, respectively.
8 Modify the query in Step 7 to display the minimum, maximum, sum, and average salary for each job type.
9 Create a query to display the number of employees with the same job.
10 Determine the number of managers without listing them. Label the column Number of Managers. HINT: Use the MANAGER_ID column to determine the number of managers. Save your SQL statement in a text file named LAB08_4.sql. Run your query.
11 Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE.
12 Display the manager number and the salary of the lowest paid employee for that manager. Exclude anyone whose manager is not known. Exclude any groups where the minimum salary is $6,000 or less. Sort the output in descending order of salary.
13 Write a query to display each department's name, location, number of employees, and the average salary for all employees in that department. Label the columns Department , Location, Number of Workers, and Average Salary, respectively. Round the average salary to two decimal places.