

Hands-on Lab : Backup and Restore using MySQL

Estimated time needed: 25 minutes

In this lab, you will learn how to use the MySQL command line interface (CLI) to create different types of backups of a database and restore the structure and data of a database with your created backups when needed.

Objectives

After completing this lab, you will be able to use the MySQL command line to:

- Perform a Logical Backup and Restore
- Perform Point-in-Time Backup and Restoration
- Perform a Physical Backup and Restore

Software Used in this Lab

In this lab, you will use [MySQL](#). MySQL is a Relational Database Management System (RDBMS) designed to efficiently store, manipulate, and retrieve data.



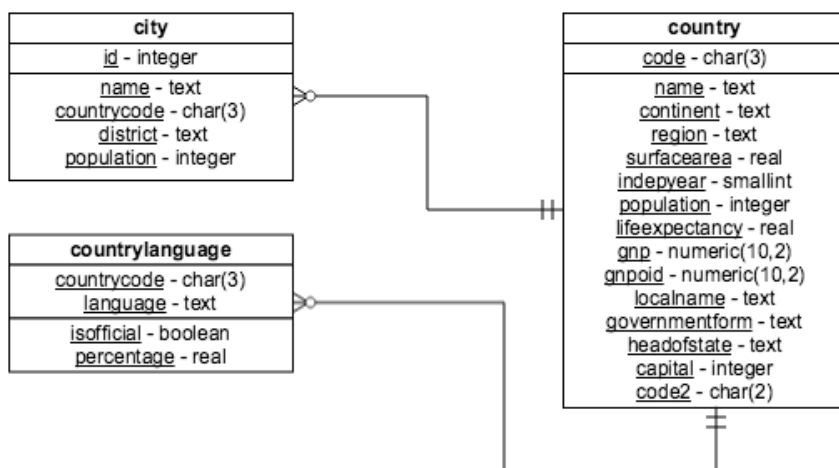
To complete this lab you will utilize the MySQL relational database service available as part of the IBM Skills Network Labs (SN Labs) Cloud IDE. SN Labs is a virtual lab environment used in this course.

Database Used in this Lab

The World database used in this lab comes from the following source: <https://dev.mysql.com/doc/world-setup/en/> under [CC BY 4.0 License](#) with [Copyright 2021 - Statistics Finland](#).

You will use a modified version of the database for the lab, so to follow the lab instructions successfully please use the database provided with the lab, rather than the database from the original source.

The following ERD diagram shows the schema of the World database:



The first row is the table name, the second is the primary key, and the remaining items are any additional attributes.

Exercises

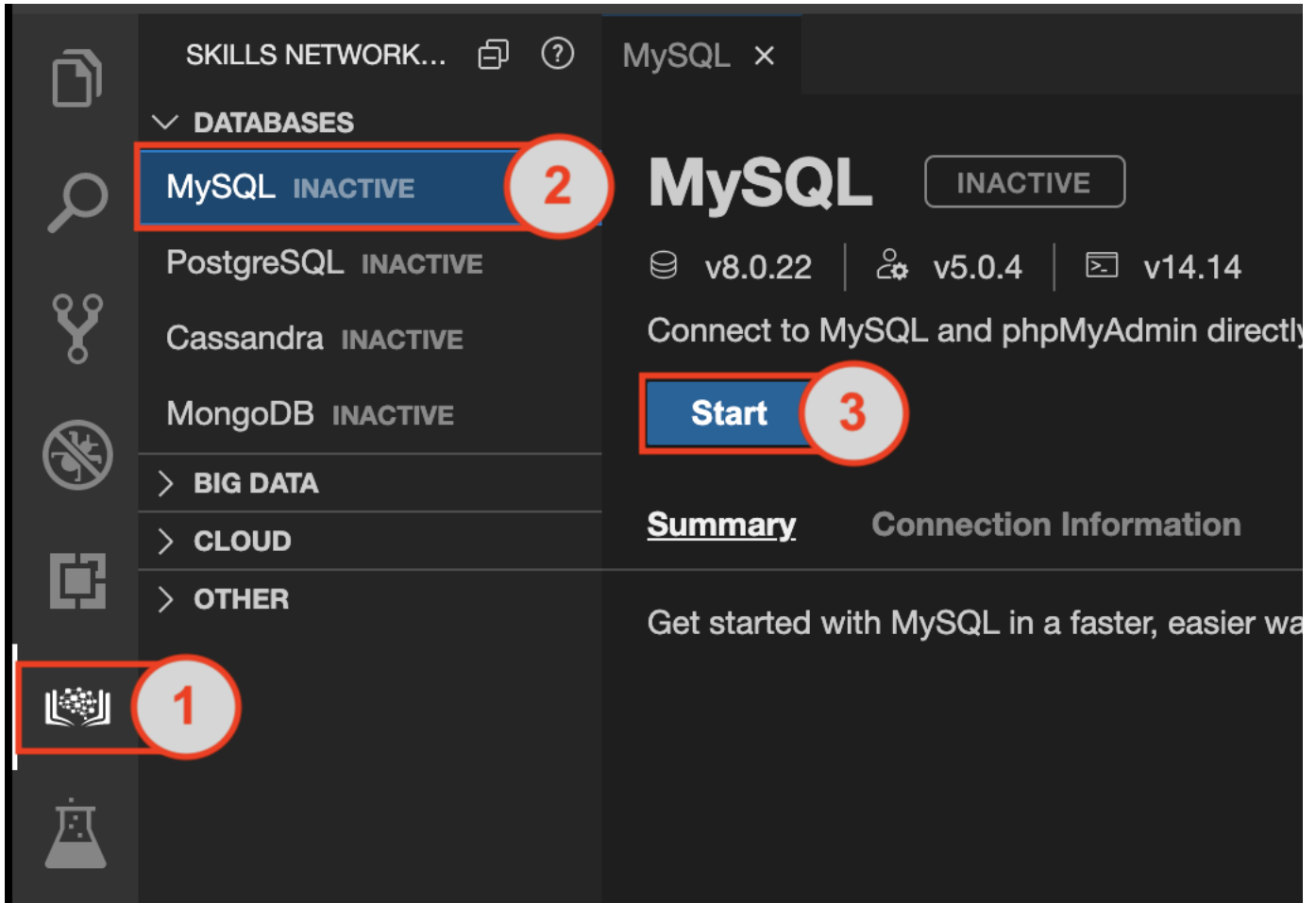
This lab is divided into two exercises: an Example Exercise and Practice Exercise.

Example Exercise A: Perform a Logical Backup and Restore

In this example exercise, you will go through an example covering how to perform a logical backup and restoration of a database table.

A logical backup creates a file containing DDL (such as create table) and DML commands (such as insert) that recreate the objects and data in the database. As such, you can use this file to recreate the database on the same or on another system. Generally, when you perform a logical backup and restore, you reclaim any wasted space from the original database since the restoration process creates a clean version of the tables. Logical backups enable you to backup granular objects. For example, you can back up an individual database table, however, you cannot use it to backup log files or database configuration settings. Suppose you are in a situation where you dropped one or more tables of a database accidentally. This is where you make use of the logical backup of a database table to restore the structure and data of the table.

1. Go to **Skills Network Toolbox** by clicking the icon shown below from the side by side launched Cloud IDE.
2. From the **Databases** drop down menu, click **MySQL** to open the MySQL service session tab.
3. Click the **Start** button and wait until MySQL service session gets launched.



The MySQL server will take a few moments to start. Once it is ready, you will see the green “Active” label near the top of the window.

The screenshot shows the Skills Network Cloud IDE interface. On the left is a sidebar with icons for various services: a document, a magnifying glass, a network diagram, a crossed-out network diagram, a square with a square inside, a book, and a flask. The main panel is titled 'SKILLS NETWORK...' and has a 'MySQL' tab selected. Under the 'DATABASES' section, 'MySQL' is listed as 'ACTIVE', while 'PostgreSQL', 'Cassandra', and 'MongoDB' are 'INACTIVE'. Below this are sections for 'BIG DATA', 'CLOUD', and 'OTHER'. The right panel shows the 'MySQL' service details. It includes a 'MySQL' title, an 'ACTIVE' status badge, and version information: 'v8.0.22', 'v5.0.4', and 'v14.14'. A 'Stop' button is visible. Below this are tabs for 'Summary' and 'Connection Information'. The 'Summary' tab contains text about connecting to MySQL and phpMyAdmin. The 'Connection Information' tab shows 'Username:' and 'Password:' fields, both with copy buttons. The password field's copy button is highlighted with a red box. Below the password field, there is text about managing MySQL via 'phpMyAdmin' (with a link icon) and 'MySQL CLI' or 'New Terminal' buttons.

- **NOTE:** Whenever you are required to enter your MySQL service session password from the MySQL service session tab at any step of the lab, copy the password by clicking on the small copy button on the right of the password block. Paste the password into the terminal using **Ctrl + V** (Mac: **⌘ + V**), and press **Enter** on the keyboard. For security reasons, you will not see the password as it is entered on the terminal.

4. Click **New Terminal** button from the mysql service session tab. Now you need to fetch two mysql script files to the Cloud IDE user session storage. Copy the command below by clicking on the little copy button on the bottom right of the codeblock. Then paste it into the terminal at the command line prompt using **Ctrl + V** (Mac: **⌘ + V**), and **Enter** on keyboard. Do this for each of the commands below one at a time.

- [world_mysql_script.sql](#)

```
1. 1
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_script.sql
```

Copied!

- [world_mysql_update_A.sql](#)

```
1. 1
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_A.sql
```

Copied!

```

theia@theiadocker-sandipsahajo: /home/project ×

theia@theiadocker-sandipsahajo:/home/project$ wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_script.sql
--2021-06-28 12:34:19-- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_script.sql
Resolving cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud (cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud)... 169.63.118.104
Connecting to cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud (cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud)|169.63.118.104|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 389649 (381K) [application/x-sql]
Saving to: 'world_mysql_script.sql'

world_mysql_script.sql      100%[=====>] 380.52K  1.21MB/s   in 0.3s

2021-06-28 12:34:20 (1.21 MB/s) - 'world_mysql_script.sql' saved [389649/389649]

theia@theiadocker-sandipsahajo:/home/project$ wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_A.sql
--2021-06-28 12:34:58-- https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_A.sql
Resolving cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud (cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud)... 169.63.118.104
Connecting to cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud (cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud)|169.63.118.104|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 254 [application/x-sql]
Saving to: 'world_mysql_update_A.sql'

world_mysql_update_A.sql    100%[=====>]      254  --.-KB/s   in 0s

2021-06-28 12:34:58 (26.9 MB/s) - 'world_mysql_update_A.sql' saved [254/254]

theia@theiadocker-sandipsahajo:/home/project$ █

```

5. Initiate a mysql command prompt session by clicking the **MySQL CLI** button from the mysql service session tab.

MySQL x

MySQL

ACTIVE

v8.0.22 | v5.0.4 | v14.14

Connect to MySQL and phpMyAdmin directly in your Skills Network Labs environment

Stop

Summary

Connection Information

Details

Your database and phpMyAdmin server are now ready to use and available with the following login credentials. For more details on how to navigate MySQL, please check out the Database section.

Username:

Password:

You can manage MySQL via:

phpMyAdmin

Or to interact with the database in the terminal, select one of these options:

MySQL CLI

New Terminal

6. Create a new database **world** using the command below in the terminal:

```
1. 1
1. CREATE DATABASE world;
```

Copied!

```
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 3039
Server version: 8.0.22 MySQL Community Server - GPL

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> create database world;
Query OK, 1 row affected (0.01 sec)

mysql> █
```

7. To use the newly created world database, use the command below in the terminal:

```
1. 1
1. USE world;
```

Copied!

```
mysql> use world;
Database changed
mysql> █
```

8. Execute the world mysql script ([world_mysql.sql](#)) to complete the world database creation process using the command below in the terminal:

```
1. 1
1. SOURCE world_mysql_script.sql;
```

Copied!

```
Query OK, 1 row affected (0.01 sec)

Query OK, 1 row affected (0.00 sec)

Query OK, 1 row affected (0.00 sec)

Query OK, 1 row affected (0.00 sec)

Query OK, 0 rows affected (0.00 sec)

mysql> █
```

9. To list all the table names from the world database, use the command below in the terminal:

```
1. 1
1. SHOW TABLES;
```

Copied!

```
mysql> SHOW TABLES;
+-----+
| Tables_in_world |
+-----+
| city             |
| country          |
| countrylanguage  |
+-----+
3 rows in set (0.00 sec)

mysql> █
```

10. Retrieve all the Canada (countrycode='CAN') related records from the **countrylanguage** table using the command below in the terminal:

```
1. 1
1. SELECT * FROM countrylanguage WHERE countrycode='CAN';
```

Copied!

```
mysql> SELECT * FROM countrylanguage WHERE countrycode='CAN';
Empty set (0.00 sec)

mysql> █
```

11. You will observe the returned result set is empty set. This means Canada related records are currently absent from the table. Run the update script ([world_mysql_update_A.sql](#)) to insert the records you were looking for.

```
1. 1
1. SOURCE world_mysql_update_A.sql;
```

Copied!

12. Now redo step-9 to verify.

```
mysql> SELECT * FROM countrylanguage WHERE countrycode='CAN';
+-----+-----+-----+-----+
| CountryCode | Language           | IsOfficial | Percentage |
+-----+-----+-----+-----+
| CAN         | Chinese            | F          | 2.5        |
| CAN         | Dutch              | F          | 0.5        |
| CAN         | English            | T          | 60.4       |
| CAN         | Eskimo Languages   | F          | 0.1        |
| CAN         | French             | T          | 23.4       |
| CAN         | German             | F          | 1.6        |
| CAN         | Italian            | F          | 1.7        |
| CAN         | Polish             | F          | 0.7        |
| CAN         | Portuguese         | F          | 0.7        |
| CAN         | Punjabi            | F          | 0.7        |
| CAN         | Spanish            | F          | 0.7        |
| CAN         | Ukrainian          | F          | 0.6        |
+-----+-----+-----+-----+
12 rows in set (0.00 sec)

mysql> █
```

13. Quit the MySQL command prompt session using the command below in the terminal:

```
1. 1
1. \q
```

Copied!

```
mysql> \q
Bye
theia@theiadocker-sandipsahajo:/home/project$
```

14. Now backup the **countrylanguage** table of the **world** database using the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysqldump --host=127.0.0.1 --port=3306 --user=root --password world countrylanguage > world_countrylanguage_mysql_backup.sql
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysqldump --host=127.0.0.1 --port=3306 --user=root --password
world countrylanguage > world_countrylanguage_mysql_backup.sql
Enter password:
theia@theiadocker-sandipsahajo:/home/project$
```

15. To view the contents of the backup file within the terminal, use the command below:

```
1. 1
1. cat world_countrylanguage_mysql_backup.sql
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project $
'T',47.5),('WSM','Samoan-English','F',52.0),('YEM','Arabic','T',99.6),('YEM','Soqutri','F',0.0),('YUG','Alba
niana','F',16.5),('YUG','Hungarian','F',3.4),('YUG','Macedonian','F',0.5),('YUG','Romani','F',1.4),('YUG','S
erbo-Croatian','T',75.2),('YUG','Slovak','F',0.7),('ZAF','Afrikaans','T',14.3),('ZAF','English','T',8.5),('Z
AF','Ndebele','F',1.5),('ZAF','Northsotho','F',9.1),('ZAF','Southsotho','F',7.6),('ZAF','Swazi','F',2.5),('Z
AF','Tsonga','F',4.3),('ZAF','Tswana','F',8.1),('ZAF','Venda','F',2.2),('ZAF','Xhosa','T',17.7),('ZAF','Zulu
','T',22.7),('ZMB','Bemba','F',29.7),('ZMB','Chewa','F',5.7),('ZMB','Lozi','F',6.4),('ZMB','Nsenga','F',4.3)
,('ZMB','Nyanja','F',7.8),('ZMB','Tongan','F',11.0),('ZWE','English','T',2.2),('ZWE','Ndebele','F',16.2),('Z
WE','Nyanja','F',2.2),('ZWE','Shona','F',72.1);
/*!40000 ALTER TABLE `countrylanguage` ENABLE KEYS */;
UNLOCK TABLES;
/*!40103 SET TIME_ZONE=@OLD_TIME_ZONE */;

/*!40101 SET SQL_MODE=@OLD_SQL_MODE */;
/*!40014 SET FOREIGN_KEY_CHECKS=@OLD_FOREIGN_KEY_CHECKS */;
/*!40014 SET UNIQUE_CHECKS=@OLD_UNIQUE_CHECKS */;
/*!40101 SET CHARACTER_SET_CLIENT=@OLD_CHARACTER_SET_CLIENT */;
/*!40101 SET CHARACTER_SET_RESULTS=@OLD_CHARACTER_SET_RESULTS */;
/*!40101 SET COLLATION_CONNECTION=@OLD_COLLATION_CONNECTION */;
/*!40111 SET SQL_NOTES=@OLD_SQL_NOTES */;

-- Dump completed on 2021-06-28 13:19:45
theia@theiadocker-sandipsahajo:/home/project$
```

16. Run the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="DROP TABLE world.countrylanguage;"
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="DROP TABLE world.countrylanguage;"
Enter password:
theia@theiadocker-sandipsahajo:/home/project$
```

17. To list all the table names from the world database, use the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SHOW TABLES FROM world;"
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="SHOW TABLES FROM world;"
Enter password:
+-----+
| Tables_in_world |
+-----+
| city             |
| country          |
+-----+
theia@theiadocker-sandipsahajo:/home/project$
```

18. You will observe the table **countrylanguage** is missing from the world database. Now you are in the situation where you dropped a table of a database accidentally. This is where you will make use of the backup of the database table (you created backup **world_countrylanguage_mysql_backup.sql**) to restore the structure and data of the table.

19. To restore the structure and data of the table **countrylanguage**, use the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password world < world_countrylanguage_mysql_backup.sql
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
world < world_countrylanguage_mysql_backup.sql
Enter password:
theia@theiadocker-sandipsahajo:/home/project$
```

20. Now redo step-17 to verify.

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="SHOW TABLES FROM world;"
Enter password:
+-----+
| Tables_in_world |
+-----+
| city             |
| country          |
| countrylanguage  |
+-----+
theia@theiadocker-sandipsahajo:/home/project$
```

21. Again retrieve all the Canada (countrycode='CAN') related records from the **countrylanguage** table using the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SELECT * FROM world.countrylanguage WHERE countrycode='CAN';"
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="SELECT * FROM world.countrylanguage WHERE countrycode='CAN';"
Enter password:
+-----+-----+-----+-----+
| CountryCode | Language           | IsOfficial | Percentage |
+-----+-----+-----+-----+
| CAN         | Chinese            | F          | 2.5        |
| CAN         | Dutch              | F          | 0.5        |
| CAN         | English            | T          | 60.4       |
| CAN         | Eskimo Languages   | F          | 0.1        |
| CAN         | French             | T          | 23.4       |
| CAN         | German             | F          | 1.6        |
| CAN         | Italian            | F          | 1.7        |
| CAN         | Polish             | F          | 0.7        |
| CAN         | Portuguese         | F          | 0.7        |
| CAN         | Punjabi            | F          | 0.7        |
| CAN         | Spanish            | F          | 0.7        |
| CAN         | Ukrainian          | F          | 0.6        |
+-----+-----+-----+-----+
theia@theiadocker-sandipsahajo:/home/project$
```

Example Exercise B: Perform Point-in-Time Backup and Restore

In this example exercise, you will go through an example on how to perform a point-in-time backup and restore of a database.

Say you have a full logical backup of your whole database in your last mysqldump file as of yesterday evening. However, several changes may have been made (including data loss) since then. Using point-in-time backup and restore, you can get each and every change that occurred since then, so that even after your last logical backup you have a record of all new transactions. Point-in-time backup is the set of binary log files generated subsequent to a logical backup operation of a database. The binary log files contain events that describe database changes such as table creation operations or changes to table data. To restore a database to a point-in-time, you will be using binary log files containing changes of a database for a time interval along with the last logical backup of the database.

1. Click **New Terminal** button from the mysql service session tab.
2. Now you need to fetch a mysql script file to the Cloud IDE user session storage. Copy the command below by clicking on the little copy button on the bottom right of the codeblock. Then paste it into the terminal at the command line prompt using **Ctrl + V** (Mac: **⌘ + V**), and **Enter** on keyboard.

- [world_mysql_update_B.sql](#)

```
1. 1
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_
```

Copied!

3. First create a full logical backup of the current state of your whole **world** database. Use the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysqldump --host=127.0.0.1 --port=3306 --user=root --password --flush-logs --delete-master-logs --databases world > world_mysql_full_backu
```

Copied!

- **NOTE:** The two parameters in the command above, **--flush-logs** (starts writing to a new binlog file) and **--delete-master-logs** (removes old binlog files) ensures that there will be only binary log files created after a full logical backup.

4. Initiate a mysql command prompt session by clicking the **MySQL CLI** button from the mysql service session tab.

MySQL x

MySQL

ACTIVE

v8.0.22

v5.0.4

v14.14

Connect to MySQL and phpMyAdmin directly in your Skills Network Labs environment

Stop

Summary

Connection Information

Details

Your database and phpMyAdmin server are now ready to use and available with the following login credentials. For more details on how to navigate MySQL, please check out the Database section.

Username:

Password:

You can manage MySQL via:

phpMyAdmin

Or to interact with the database in the terminal, select one of these options:

MySQL CLI

New Terminal

5. To use the already created world database of example exercise A, use the command below in the terminal:

```
1. 1
1. use world;
```

Copied!

6. List all the table names from the world database using the command below in the terminal:

```
1. 1
1. SHOW TABLES;
```

Copied!

7. Retrieve all the Canada (countrycode='CAN') related records from the **city** table using the command below in the terminal:

```
1. 1
1. SELECT * FROM city WHERE countrycode='CAN';
```

Copied!

```
mysql> SELECT * FROM city WHERE countrycode='CAN';
Empty set (0.00 sec)

mysql> █
```

8. You will observe the returned result set is empty set. This means Canada related records are currently absent from the table. Run the update script ([world_mysql_update_B.sql](#)) to insert the records you were looking for.

```
1. 1
1. source world_mysql_update_B.sql;
```

Copied!

9. Now redo step-7 to verify.

```
mysql> SELECT * FROM city WHERE countrycode='CAN';
```

ID	Name	CountryCode	District	Population
1810	Montréal	CAN	Québec	1016376
1811	Calgary	CAN	Alberta	768082
1812	Toronto	CAN	Ontario	688275
1813	North York	CAN	Ontario	622632
1814	Winnipeg	CAN	Manitoba	618477
1815	Edmonton	CAN	Alberta	616306
1816	Mississauga	CAN	Ontario	608072
1817	Scarborough	CAN	Ontario	594501
1818	Vancouver	CAN	British Columbia	514008
1819	Etobicoke	CAN	Ontario	348845
1820	London	CAN	Ontario	339917
1821	Hamilton	CAN	Ontario	335614
1822	Ottawa	CAN	Ontario	335277
1823	Laval	CAN	Québec	330393
1824	Surrey	CAN	British Columbia	304477
1825	Brampton	CAN	Ontario	296711
1826	Windsor	CAN	Ontario	207588
1827	Saskatoon	CAN	Saskatchewan	193647
1828	Kitchener	CAN	Ontario	189959
1829	Markham	CAN	Ontario	189098
1830	Regina	CAN	Saskatchewan	180400
1831	Burnaby	CAN	British Columbia	179209
1832	Québec	CAN	Québec	167264
1833	York	CAN	Ontario	154980
1834	Richmond	CAN	British Columbia	148867
1835	Vaughan	CAN	Ontario	147889
1836	Burlington	CAN	Ontario	145150
1837	Oshawa	CAN	Ontario	140173
1838	Oakville	CAN	Ontario	139192
1839	Saint Catharines	CAN	Ontario	136216
1840	Longueuil	CAN	Québec	127977
1841	Richmond Hill	CAN	Ontario	116428
1842	Thunder Bay	CAN	Ontario	115913
1843	Nepean	CAN	Ontario	115100
1844	Cape Breton	CAN	Nova Scotia	114733
1845	East York	CAN	Ontario	114034
1846	Halifax	CAN	Nova Scotia	113910
1847	Cambridge	CAN	Ontario	109186
1848	Gloucester	CAN	Ontario	107314
1849	Abbotsford	CAN	British Columbia	105403
1850	Guelph	CAN	Ontario	103593
1851	Saint John's	CAN	Newfoundland	101936
1852	Coquitlam	CAN	British Columbia	101820
1853	Saanich	CAN	British Columbia	101388
1854	Gatineau	CAN	Québec	100702

10. Quit the MySQL command prompt session using the command below in the terminal:

```
1. 1
1. \q
Copied!
```

11. Now you will create a scenario where a database crash will be conducted intentionally which will result a significant loss of your **world** database files. To create the scenario, copy the command below by clicking on the little copy button on the bottom right of the codeblock. Then paste it into the terminal at the command line prompt using **Ctrl + V** (Mac: **⌘ + V**), and **Enter** on keyboard. Do this for each of the commands below one at a time.

```
1. 1
1. docker exec mysql-mysql-1 rm -rf /var/lib/mysql/world
Copied!
```

```
1. 1
1. docker exec -it mysql-mysql-1 mysqladmin -p shutdown
Copied!
```

```
theia@theiadosker-sandipsahajo:/home/project$ docker exec mysql_mysql_1 rm -rf /var/lib/mysql/world
theia@theiadosker-sandipsahajo:/home/project$ docker exec -it mysql_mysql_1 mysqladmin -p shutdown
Enter password: █
```

12. Try to retrieve records from any table of the database using like the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SELECT * FROM world.city;"
Copied!
```

```
theia@theiadosker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="SELECT * FROM world.city;"
Enter password:
ERROR 1812 (HY000) at line 1: Tablespace is missing for table `world`.`city`.
theia@theiadosker-sandipsahajo:/home/project$ █
```

13. You will face errors since a significant loss of your **world** database files happened. Now you have to restore the world database along with the updates you made earlier in this exercise running the update script ([world_mysql_update_B.sql](#)). Display the binary logs using the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SHOW BINARY LOGS;"
Copied!
```

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="SHOW BINARY LOGS;"
Enter password:
+-----+-----+-----+
| Log_name | File_size | Encrypted |
+-----+-----+-----+
| binlog.000003 | 15827 | No |
| binlog.000004 | 156 | No |
+-----+-----+-----+
theia@theiadocker-sandipsahajo:/home/project$
```

14. Write the contents of all binary log files listed above to a single file using the command below in the terminal:

```
1. 1
1. docker exec mysql-mysql-1 mysqlbinlog /var/lib/mysql/binlog.000003 /var/lib/mysql/binlog.000004 > logfile.sql
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ docker exec mysql-mysql-1 mysqlbinlog /var/lib/mysql/binlog.000003
/var/lib/mysql/binlog.000004 > logfile.sql
theia@theiadocker-sandipsahajo:/home/project$
```

15. You are ready to perform point-in-time restore. First restore the full logical backup of your whole **world** database you created earlier in this exercise using the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password < world_mysql_full_backup.sql
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
< world_mysql_full_backup.sql
Enter password:
theia@theiadocker-sandipsahajo:/home/project$
```

16. To verify if you have the updates from the update script ([world_mysql_update_B.sql](#)), retrieve all the Canada (countrycode='CAN') related records from the **city** table using the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SELECT * FROM world.city WHERE countrycode='CAN';"
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="SELECT * FROM world.city WHERE countrycode='CAN';"
Enter password:
theia@theiadocker-sandipsahajo:/home/project$
```

17. Now run the logfile you created in step-14 using the command below in the terminal (enter your MySQL service session password from the MySQL service session tab if necessary):

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password < logfile.sql
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
< logfile.sql
Enter password:
theia@theiadocker-sandipsahajo:/home/project$
```

18. Redo step-16 to verify if you have the updates from the update script ([world_mysql_update_B.sql](#)).

```
theia@theiadocker-sandipsahajo:/home/project$ mysql --host=127.0.0.1 --port=3306 --user=root --password
--execute="SELECT * FROM world.city WHERE countrycode='CAN';"
Enter password:
```

ID	Name	CountryCode	District	Population
1810	Montréal	CAN	Québec	1016376
1811	Calgary	CAN	Alberta	768082
1812	Toronto	CAN	Ontario	688275
1813	North York	CAN	Ontario	622632
1814	Winnipeg	CAN	Manitoba	618477
1815	Edmonton	CAN	Alberta	616306
1816	Mississauga	CAN	Ontario	608072
1817	Scarborough	CAN	Ontario	594501
1818	Vancouver	CAN	British Columbia	514008
1819	Etobicoke	CAN	Ontario	348845
1820	London	CAN	Ontario	339917
1821	Hamilton	CAN	Ontario	335614
1822	Ottawa	CAN	Ontario	335277
1823	Laval	CAN	Québec	330393
1824	Surrey	CAN	British Columbia	304477
1825	Brampton	CAN	Ontario	296711
1826	Windsor	CAN	Ontario	207588
1827	Saskatoon	CAN	Saskatchewan	193647
1828	Kitchener	CAN	Ontario	189959
1829	Markham	CAN	Ontario	189098
1830	Regina	CAN	Saskatchewan	180400
1831	Burnaby	CAN	British Columbia	179209
1832	Québec	CAN	Québec	167264
1833	York	CAN	Ontario	154980
1834	Richmond	CAN	British Columbia	148867
1835	Vaughan	CAN	Ontario	147889
1836	Burlington	CAN	Ontario	145150
1837	Oshawa	CAN	Ontario	140173
1838	Oakville	CAN	Ontario	139192
1839	Saint Catharines	CAN	Ontario	136216
1840	Longueuil	CAN	Québec	127977
1841	Richmond Hill	CAN	Ontario	116428
1842	Thunder Bay	CAN	Ontario	115913
1843	Nepean	CAN	Ontario	115100
1844	Cape Breton	CAN	Nova Scotia	114733
1845	East York	CAN	Ontario	114034
1846	Halifax	CAN	Nova Scotia	113910
1847	Cambridge	CAN	Ontario	109186
1848	Gloucester	CAN	Ontario	107314
1849	Abbotsford	CAN	British Columbia	105403
1850	Guelph	CAN	Ontario	103593
1851	Saint John's	CAN	Newfoundland	101936
1852	Coquitlam	CAN	British Columbia	101820
1853	Saanich	CAN	British Columbia	101388

19. Finally through the point-in-time recovery, you have the **world** database in the same state before you conducted the intentional crash scenario.

Example Exercise C: Perform Physical Backup and Restore

In this example exercise, you will go through an example on how to perform a physical backup and restore of a database.

A physical or raw backup creates a copy of all the physical storage files and directories that belong to a table, database, or other object, including the data files, configuration files, and log files. Physical backups are often smaller and quicker than logical backups, so are useful for large or important databases that require fast recovery times. You will be performing a storage level snapshots as physical backup. This method is common for databases utilizing specialized cloud storage systems like the one you are using for this lab provide by the Skills Network Labs.

1. Click **New Terminal** button from the mysql service session tab.
2. To perform physical backup, you will take a storage snapshot of your MySQL server data directory within the docker container of the Skills Network Labs specialized cloud system. Then copy that to your Cloud IDE user session storage. Use the command below in the terminal:

```
1. 1
1. docker cp mysql-mysql-1:/var/lib/mysql /home/project/mysql_backup
```

Copied!

```
theia@theiadocker-sandipsahajo:/home/project ×
theia@theiadocker-sandipsahajo:/home/project$ docker cp mysql-mysql-1:/var/lib/mysql /home/project/mysql_backup
theia@theiadocker-sandipsahajo:/home/project$
```

TIPS: Say instead of taking snapshot of the whole MySQL server data directory which may contain several databases, you want to take snapshot of your specific **world** database for physical backup. The command for that should look like: `docker cp mysql-mysql-1:/var/lib/mysql/world /home/project/mysql_world_backup`

3. Click the **Explorer** icon as shown below in the Cloud IDE to access the user session storage. **mysql_backup** folder will appear which you created as physical backup in step-2. You can click the folder to explore the contents of the created physical backup.

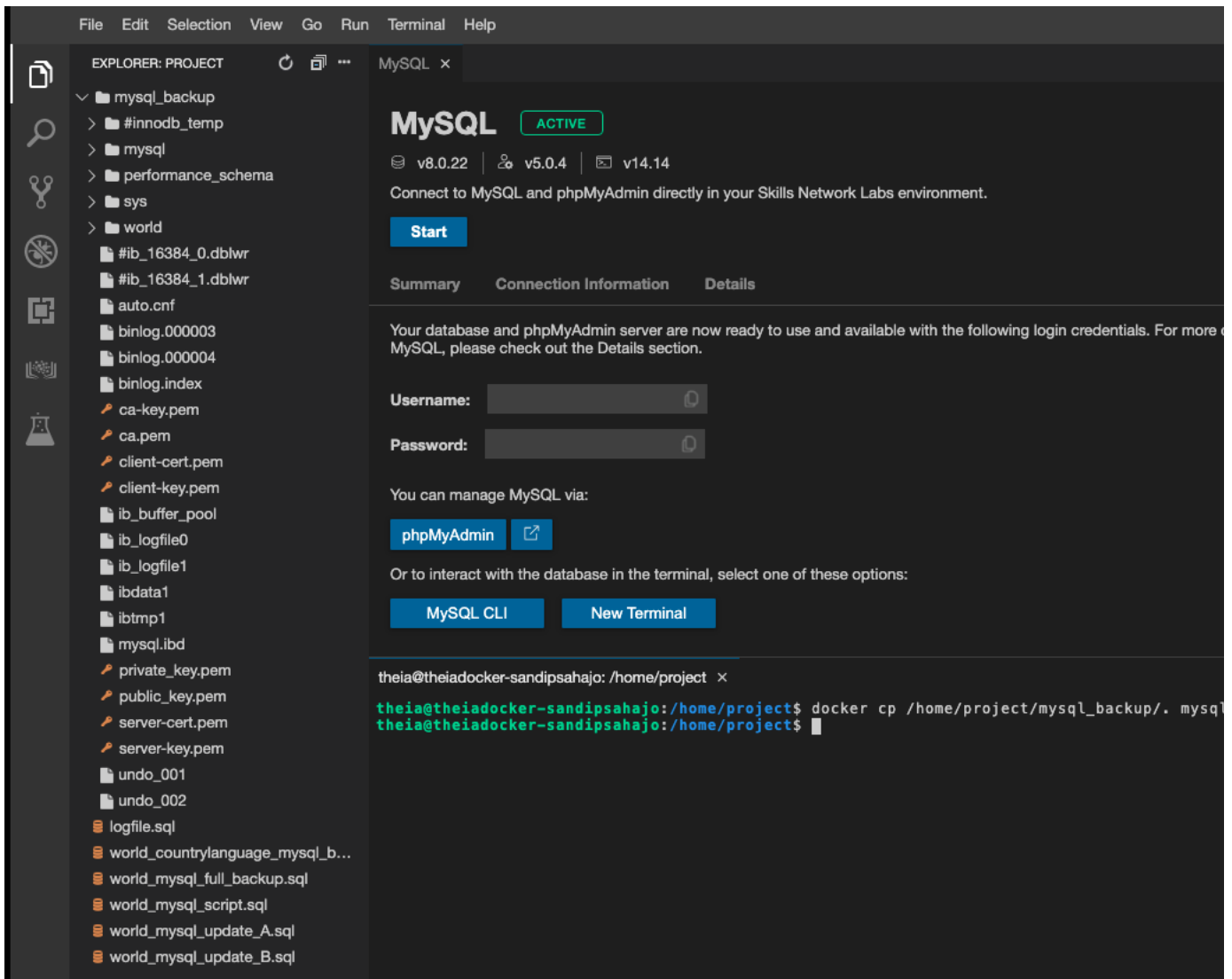
The screenshot displays a web-based IDE interface. On the left, the 'EXPLORER: PROJECT' sidebar shows a directory tree with a 'mysql_backup' folder highlighted. This folder contains subdirectories like '#innodb_temp', 'mysql', 'performance_schema', 'sys', and 'world', along with various files including certificates, log files, and SQL scripts. The main workspace area is titled 'MySQL' and shows the instance is 'ACTIVE' with version 'v8.0.22'. It includes a 'Start' button and tabs for 'Summary', 'Connection Information', and 'Details'. The 'Summary' tab displays login credentials for 'Username' and 'Password'. Below this, there are buttons for 'phpMyAdmin' and 'MySQL CLI', and a 'New Terminal' button. A terminal window at the bottom shows the command: `docker cp mysql_mysql_1:/var/lib/mysql /home/project`.

4. When needed, you can restore the physical backup using the command below in the terminal:

```
1. 1
1. docker cp /home/project/mysql_backup/. mysql-mysql-1:/var/lib/mysql
```

Copied!

NOTE: For this exercise, you don't need to run this command.



Practice Exercise 1: Perform Logical Backup and Restore

In this practice exercise, you will practice performing a logical backup and restore of a database table.

Scenario: You are planning to update and migrate one of the tables from your **world** database to a new MySQL server. Perform a logical backup of the table **city** from the database **world**. The backup table is expected to contain data of **Bangladesh**. Validate if your created backup is in working state.

▼ Hint (Click Here)

1. Create a new database with any name like **world_P1**.
2. Use **world_mysql_script.sql** script to complete the world_P1 database creation process.
3. Try to retrieve all the records with **BGD** countrycode from the **city** table.
4. If you fail, try updating the database using **world_mysql_update_1.sql**(https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_1.sql) script.
5. Perform a logical backup of the **city** table.
6. Drop the **city** table and try to restore it with the backup you created to validate if your created backup is in working state.

▼ Solution (Click Here)

1. Fetch the necessary scripts files to the Cloud IDE user session storage using Cloud IDE **Terminal**.

- [world_mysql_script.sql](#)

```
1. 1
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_script.sql
```

Copied!

- [world_mysql_update_1.sql](#)

```
1. 1
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_1.sql
```

Copied!

2. Create a new database with any name like **world_P1** using **MySQL CLI**.

```
1. 1
1. create database world_P1;
```

Copied!

```
1. 1
1. use world_P1;
```

Copied!

3. Use **world_mysql_script.sql** script to complete the world_P1 database creation process.

```
1. 1
1. source world_mysql_script.sql;
```

Copied!

4. Try to retrieve all the records with **BGD** countrycode from the **city** table.

```
1. 1
1. SELECT * FROM city WHERE countrycode='BGD';
```

Copied!

5. If you fail, try updating the database using **world_mysql_update_1.sql** script.

```
1. 1
1. source world_mysql_update_1.sql;
```

Copied!

```
1. 1
1. SELECT * FROM city WHERE countrycode='BGD';
```

Copied!

6. Perform a logical backup of the **city** table.

```
1. 1
1. \q
```

Copied!

```
1. 1
1. mysqldump --host=127.0.0.1 --port=3306 --user=root --password world_P1 city > world_P1_city_mysql_backup.sql
```

Copied!

7. Drop the **city** table and try to restore it with the backup you created to validate if your created backup is in working state.

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="DROP TABLE world_P1.city;"
```

Copied!

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SELECT * FROM world_P1.city;"
```

Copied!

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password world_P1 < world_P1_city_mysql_backup.sql
```

Copied!

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SELECT * FROM world_P1.city;"
```

Copied!

Practice Exercise 2: Perform Physical Backup and Restore

In this practice exercise, you will practice performing a physical backup and restore of a database table.

Scenario: *Perform a physical backup of the database **world**. The backup database is expected to contain data of **Canada** as well as **Bangladesh**.*

▼ Hint (Click Here)

1. Create a new database with any name like **world_P2**.
2. Use **world_mysql_script.sql** script to complete the world_P2 database creation process.
3. Try to retrieve all the records with **BGD** as well as **CAN** countrycodes from all the tables.
4. If you fail, try updating the database using [world_mysql_update_2.sql](https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_2.sql)(https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_2.sql) script.
5. Perform a physical backup of the database.
6. Remove the **world_P2** database directory from the mysql server docker container and try to restore it with the backup you created to validate if your created backup is in working state.

▼ Solution (Click Here)

1. Fetch the necessary scripts files to the Cloud IDE user session storage using Cloud IDE **Terminal**.

- [world_mysql_script.sql](#)

```
1. 1
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_script.
```

Copied!

- [world_mysql_update_2.sql](#)

```
1. 1
1. wget https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DB0231EN-SkillsNetwork/datasets/World/world_mysql_update_
```

Copied!

2. Create a new database with any name like **world_P2** using **MySQL CLI**.

```
1. 1
1. create database world_P2;
```

Copied!

```
1. 1
```

```
1. use world_P2;
```

Copied!

3. Use **world_mysql_script.sql** script to complete the world_P2 database creation process.

```
1. 1
1. source world_mysql_script.sql;
```

Copied!

4. Try to retrieve all the records with **BGD** and **CAN** countrycode from all the tables.

```
1. 1
1. SELECT * FROM country WHERE code in ('BGD','CAN');
```

Copied!

```
1. 1
1. SELECT * FROM countrylanguage WHERE countrycode in ('BGD','CAN');
```

Copied!

```
1. 1
1. SELECT * FROM city WHERE countrycode in ('BGD','CAN');
```

Copied!

5. If you fail, try updating the database using **world_mysql_update_2.sql** script. Then redo the previous step to validate.

```
1. 1
1. source world_mysql_update_2.sql;
```

Copied!

6. Perform a physical backup of the database.

```
1. 1
1. \q
```

Copied!

```
1. 1
1. docker cp mysql-mysql-1:/var/lib/mysql/world_P2 /home/project/mysql_world_P2_backup
```

Copied!

7. Remove the **world_P2** database directory from the mysql server docker container and try to restore it with the backup you created to validate if your created backup is in working state.

```
1. 1
1. docker exec mysql-mysql-1 rm -rf /var/lib/mysql/world_P2
```

Copied!

```
1. 1
1. docker exec -it mysql-mysql-1 mysqladmin -p shutdown
```

Copied!

NOTE: The above command restarts the mysql server which is necessary after making changes to the mysql server data directory.

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SELECT * FROM world_P2.city;"
```

Copied!

```
1. 1
1. docker cp /home/project/mysql_world_P2_backup/. mysql-mysql-1:/var/lib/mysql/world_P2
```

Copied!

```
1. 1
1. docker exec -it mysql-mysql-1 mysqladmin -p shutdown
```

Copied!

NOTE: The above command restarts the mysql server which is necessary after making changes to the mysql server data directory.

```
1. 1
1. mysql --host=127.0.0.1 --port=3306 --user=root --password --execute="SELECT * FROM world_P2.city;"
```

Copied!

Congratulations! You have completed this lab, and you are ready for the next topic.

Author(s)

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Other Contributor(s)

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Changelog

Date	Version	Changed by	Change Description
2021-06-15	1.0	Sandip Saha Joy	Created initial version
2021-10-04	1.1	David Pasternak	Updated screenshots
2022-07-12	1.2	Lakshmi Holla	Updated html tag
2023-05-15	1.3	Jaskomal Natt	Updated copyright date

