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HOL7298

MySQL DBA Primer

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HOL7298: MySQL DBA Primer

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Topics

1. Installation
2. Layout
3. Security
4. Backups
5. Monitoring

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Installation

- Bare hardware or VM installation
  - RPM or TAR.GZ?
    - YUM or not to YUM?
      - Community YUM repo
      - Direct package download
      - Local Enterprise YUM repo
        - How To Create a Local Yum Repository for MySQL Enterprise Packages (Doc ID 1947384.1)
- Cloud Instance or cloned VM
  - Where's my password?
  - Am I unique?
- `systemd` or not to be?

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Layout

- my.cnf
  - There can [not] only be one!
    - System locations
    - Personal .my.cnf
    - Security implications
- Datadir
  - Where is it?
  - What is it?
  - Do you have SELinux, do you speak AppArmor?
- Logs
  - Where are they and why should I care?

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Connections

- Sockets and ports, oh my!
  - Socket location
  - MySQL classic port
  - mysqlx
  - XCOM
- Clients
  - `mysql`
  - MySQL Workbench
  - MySQL Shell

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Connections²

- MySQL Utilities
- Connectors
  - Connector/J
  - Connector/C++
  - Connector/Python
  - Connector/NET
  - Connector/ODBC
  - Connector/Node.js
  - `libmysqlclient`
  - `mysqlnd` for PHP

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High Availability

- Synchronous solutions
  - Group Replication
    - Single and multi-Primary
    - Innodb Cluster
    - 3 server rule
- Asynchronous solutions
  - Async replication
  - Semi-sync replication
- MySQL Router

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Security

- MySQL users@hosts
- Passwords!
- Anonymous users
  - `mysql_secure_installation`
- Server configuration directory permissions
- Command line `–p` password
  - `[Warning] Using a password on the command line interface can be insecure.`
- SUPER privilege
  - Reserved connection slots!

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Backing up your data

- MySQL Enterprise Backup
  - Robust/Fast/Flexible/hot backup
  - No Partial backups without TTS [Transportable Tablespaces]
  - Requires global lock to obtain log/GTID coordinates and backup MyISAM tables
- `mysqldump`
  - Produces relatively small dumps
  - Logical backup
  - Slow to load and dumps 1 table at a time
  - Can take system lock without `--single-transaction`
  - Requires system lock for MyISAM tables

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Backing up your data

- `mysqlpump`
  - Logical dump
  - Compatible with `mysqldump`
  - Parallel table processing
  - Faster loading by creating indexes at end of table load
  - Dumping of user GRANTs
  - Compressed dumps
  - 5.7 only
  - Can take system lock without `--single-transaction`
  - Requires system lock for MyISAM tables
  - Slower than MySQL Enterprise Backup

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Monitoring

- MySQL Enterprise Monitor
  - Performance
  - Replication
  - Common faults
  - Auditing
  - Enterprise Firewall
  - Backups
  - QUAN [Query Analyzer]

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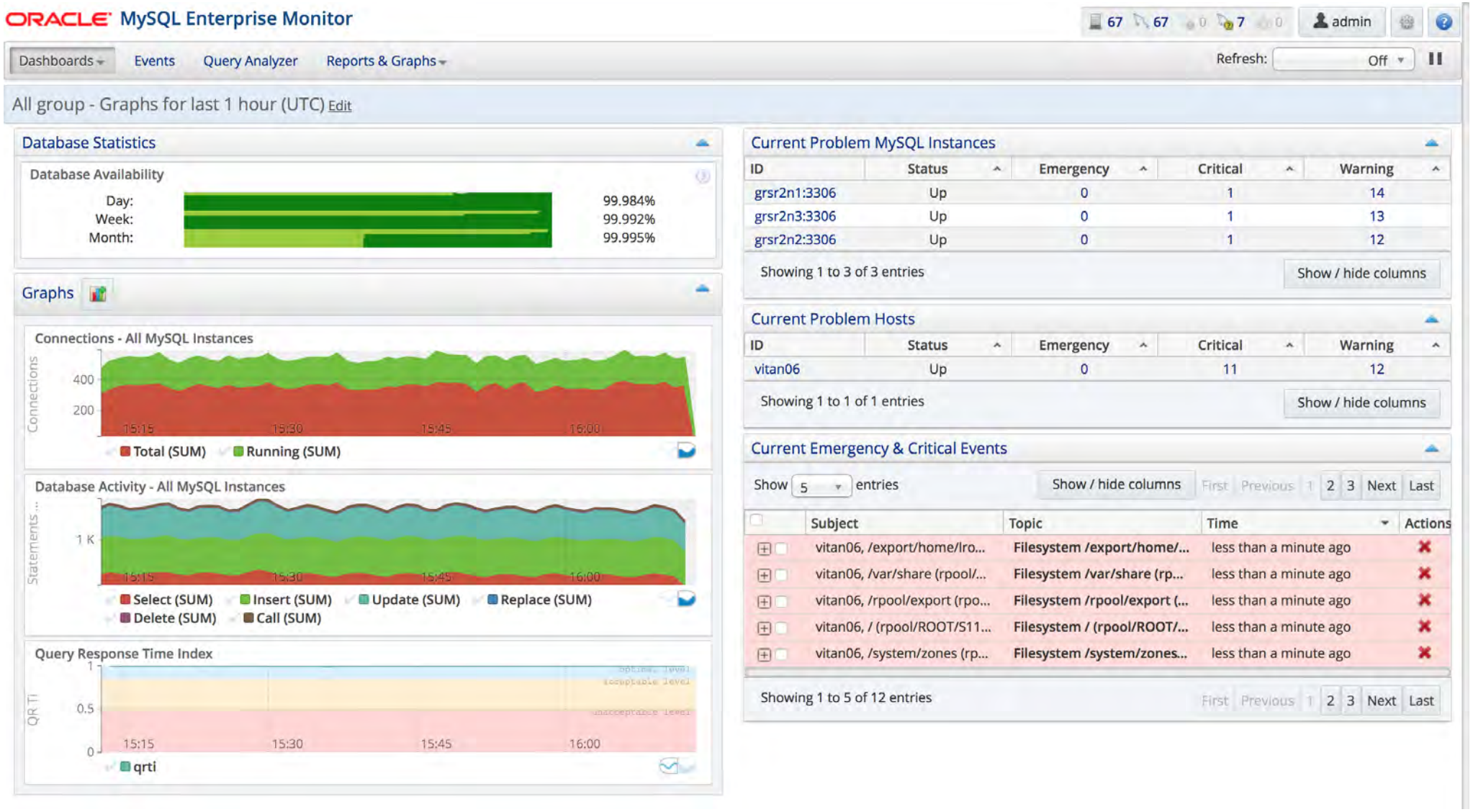
Dashboard



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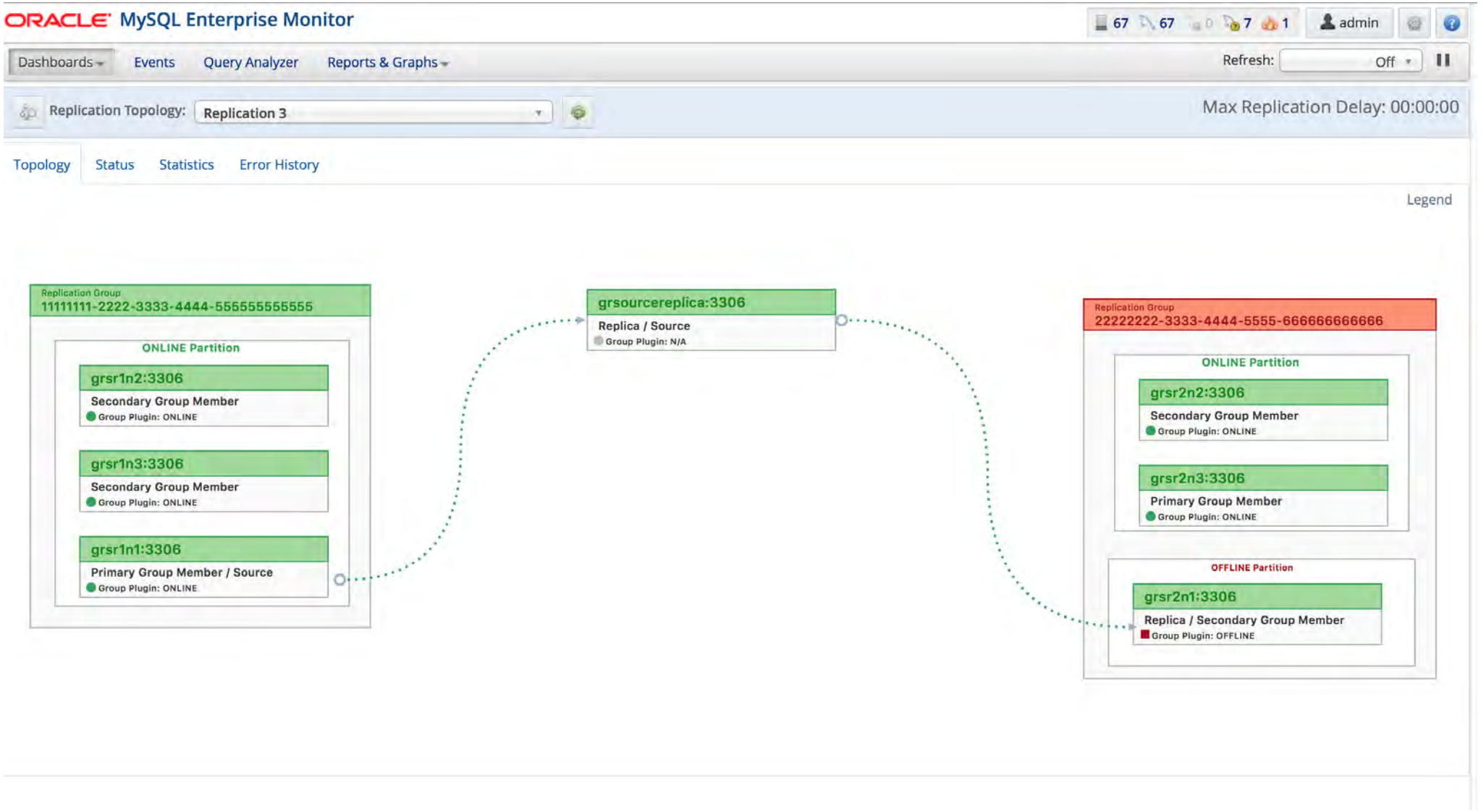
Replication Topology



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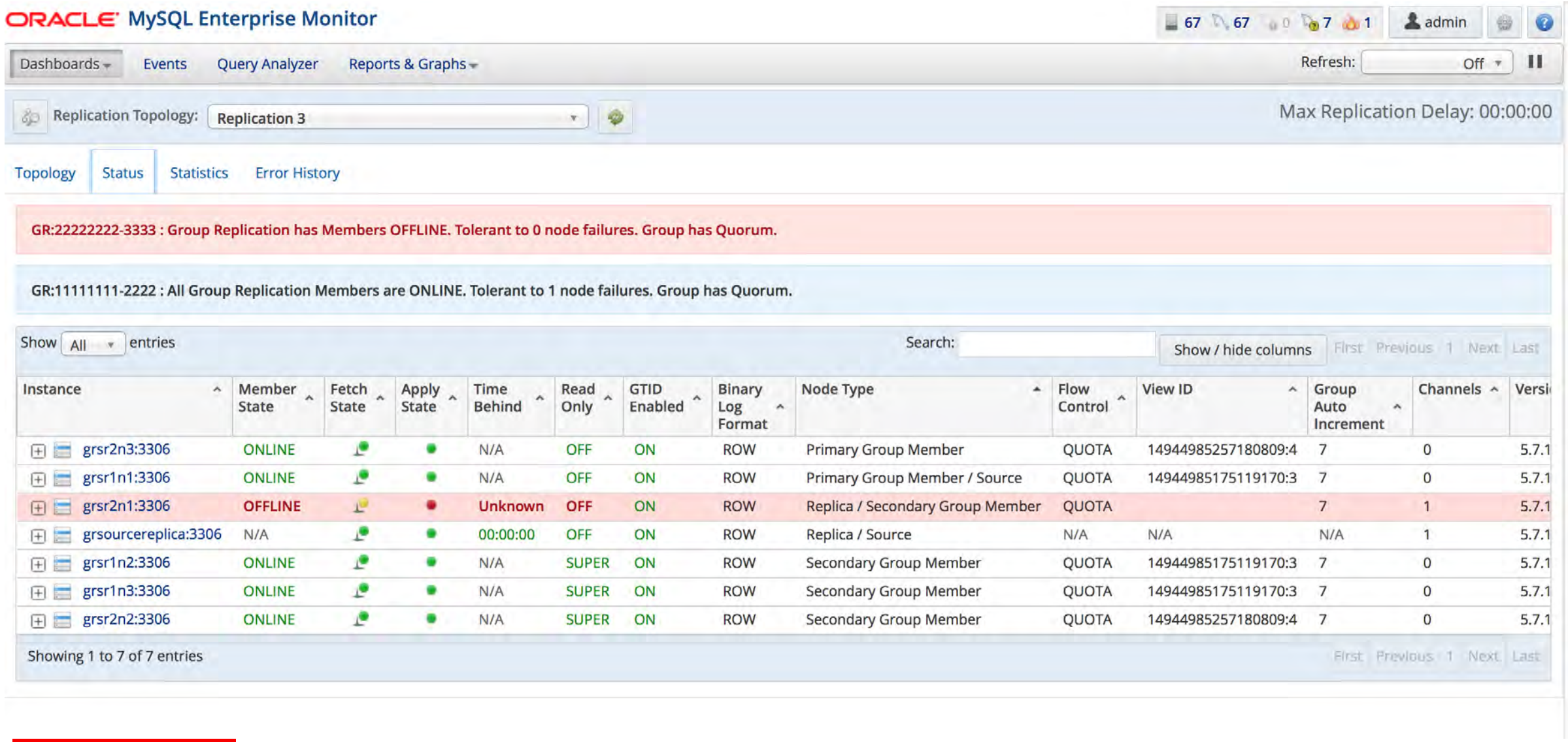
Replication Status



Instance	Member State	Fetch State	Apply State	Time Behind	Read Only	GTID Enabled	Binary Log Format	Node Type	Flow Control	View ID	Group Auto Increment	Channels	Versi
grsr2n3:3306	ONLINE			N/A	OFF	ON	ROW	Primary Group Member	QUOTA	14944985257180809:4	7	0	5.7.1
grsr1n1:3306	ONLINE			N/A	OFF	ON	ROW	Primary Group Member / Source	QUOTA	14944985175119170:3	7	0	5.7.1
grsr2n1:3306	OFFLINE			Unknown	OFF	ON	ROW	Replica / Secondary Group Member	QUOTA		7	1	5.7.1
grsourcereplica:3306	N/A			00:00:00	OFF	ON	ROW	Replica / Source	N/A	N/A	N/A	1	5.7.1
grsr1n2:3306	ONLINE			N/A	SUPER	ON	ROW	Secondary Group Member	QUOTA	14944985175119170:3	7	0	5.7.1
grsr1n3:3306	ONLINE			N/A	SUPER	ON	ROW	Secondary Group Member	QUOTA	14944985175119170:3	7	0	5.7.1
grsr2n2:3306	ONLINE			N/A	SUPER	ON	ROW	Secondary Group Member	QUOTA	14944985257180809:4	7	0	5.7.1

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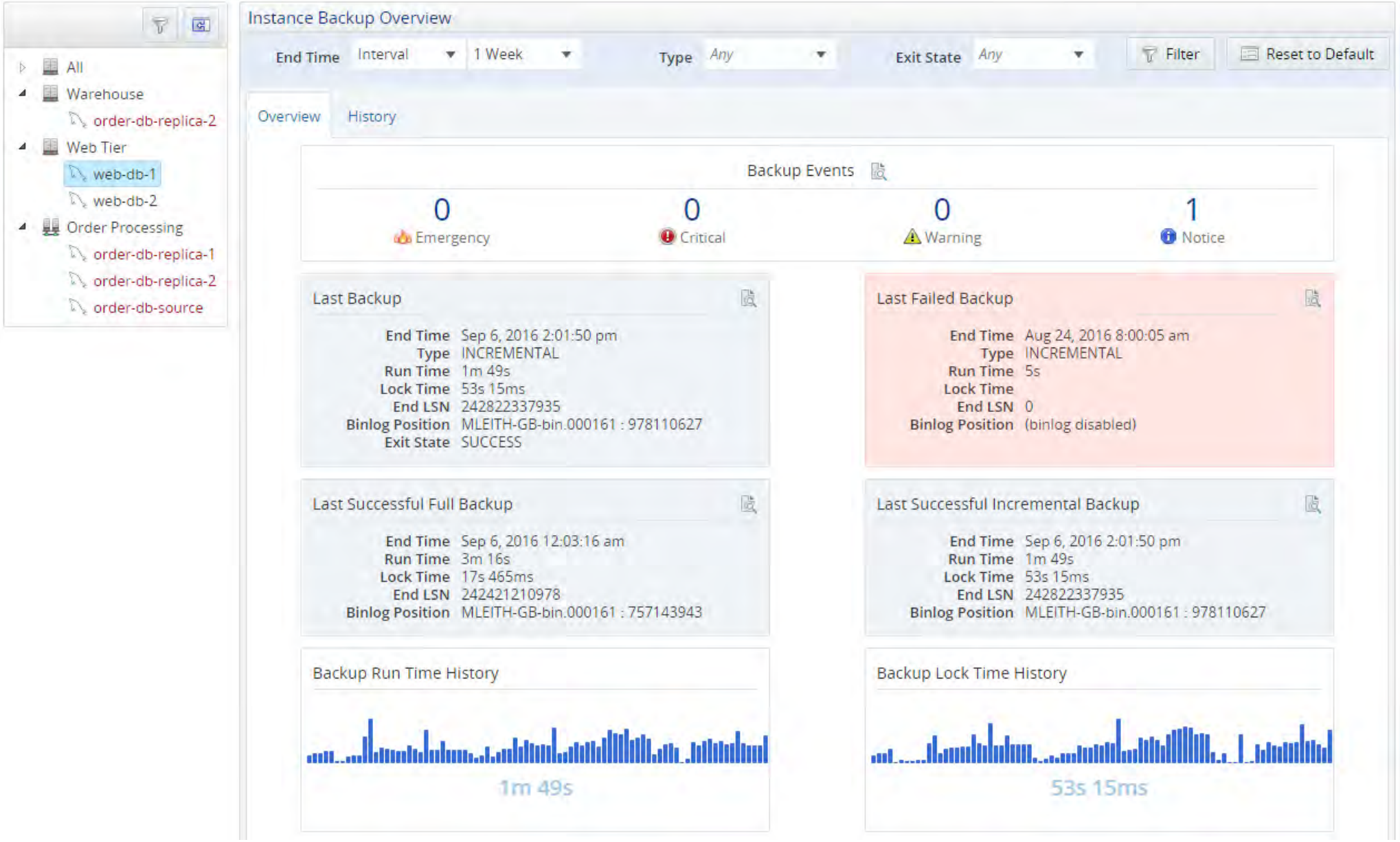
Backups



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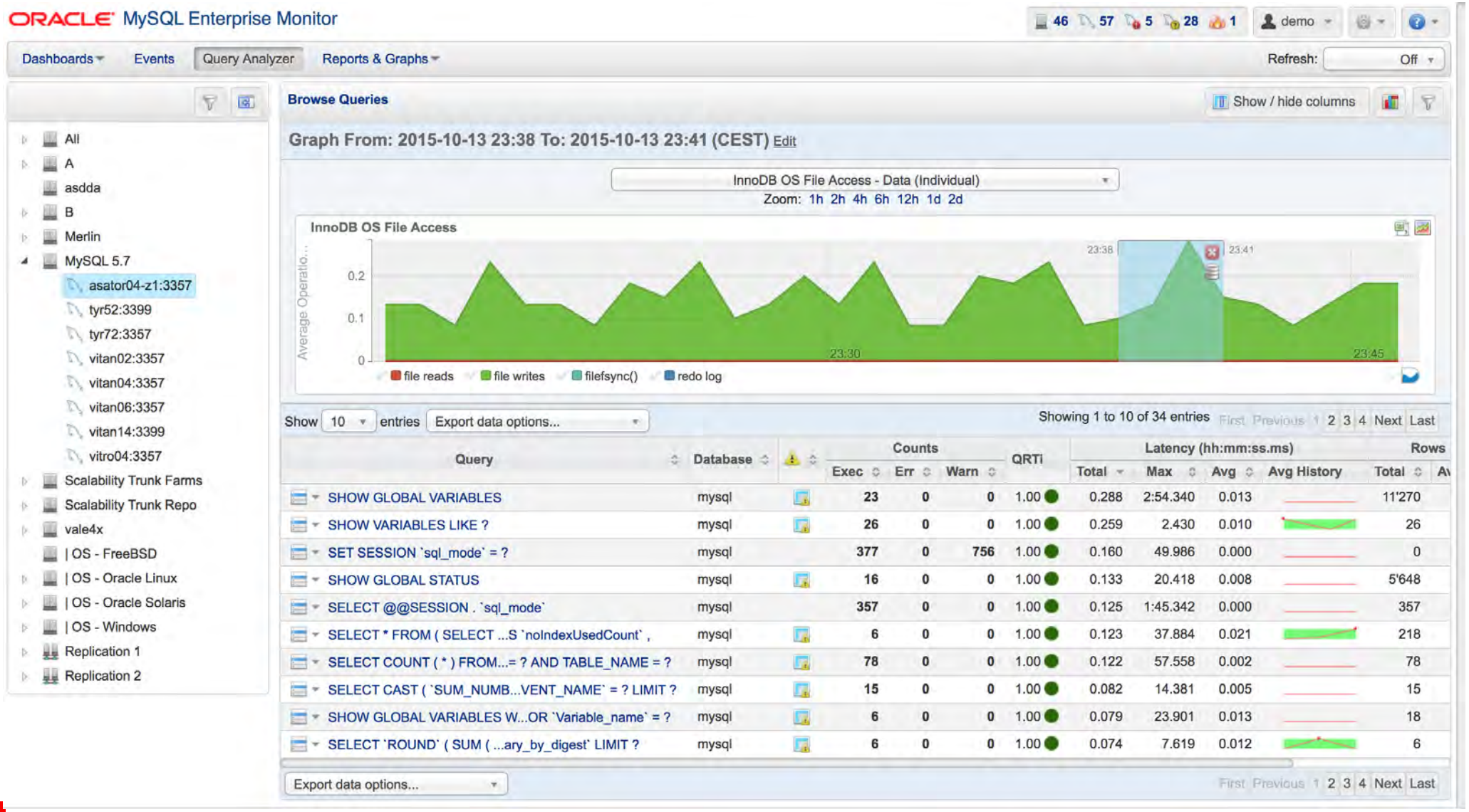
QUAN



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Exercises

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Exercise 1

Finding the password and changing it

With SaaS, the provider will typically furnish the password. If using PaaS, or installing on a bare server, the password is automatically generated.

```
shell> grep “temporary password” /var/log/mysqld.log
2017-09-14T18:35:35.516799Z 1 [Note] A temporary password is generated for root@localhost:
NTyspcip7Y<Y
```

Once password is obtained, you must login and change it:

```
shell> mysql -uroot -p
Enter password: ***********
mysql> ALTER USER root@localhost IDENTIFIED BY 'Oracle1*';
```

Now let’s disable the validate password plugin to make things easier later:

```
mysql> UNINSTALL PLUGIN validate_password;
```

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Exercise 2

Changing my.cnf and restarting

A common task for a DBA is to make a change to the MySQL configuration file and restart the MySQL instance.

The default location for the MySQL configuration file [as provided] is `/etc/my.cnf`

In this exercise we will set the SQL_MODE setting to `STRICT_ALL_TABLES` in the MySQL configuration file

```
shell> sudo su
shell# leafpad /etc/my.cnf
```

Now add the following line to the end of the file:

```
sql_mode=STRICT_ALL_TABLES
```

Once complete, click **File→Save**, then **File→Quit**

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Exercise 3

Restarting the server

When a change is made to the `my.cnf`, the server instance must be restarted for those changes to take effect. Some setting changes can only be made via the `my.cnf` and cannot be made dynamically.

Verify setting prior to restart:

```
shell> mysql -uroot -p -e "select @@global.sql_mode\G"
*************************** 1. row ***************************
@@global.sql_mode:
ONLY_FULL_GROUP_BY,STRICT_TRANS_TABLES,NO_ZERO_IN_DATE,NO_ZERO_DATE,ERROR_FOR_DIVISION_BY_ZERO,NO_AU
TO_CREATE_USER,NO_ENGINE_SUBSTITUTION
```

Restart:

```
shell> sudo su
shell# systemctl restart mysqld
```

Verify:

```
shell> mysql -uroot -p -e "select @@global.sql_mode\G"
Enter password:
*************************** 1. row ***************************
@@global.sql_mode: STRICT_ALL_TABLES
```

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Exercise 4

Loading a database dump

Once your server instance is setup and configured properly, you will need to load it with data. A common method of doing this is to load a dump file that is provided by a vendor, or is a backup from another server instance.

Obtaining the World example and uncompressing:

```
shell> wget http://downloads.mysql.com/docs/world.sql.gz
world.sql.gz        100%[===================>]  89.94K   254KB/s    in 0.4s

shell> gzip -d world.sql.gz
```

Loading the World database dump and verifying:

```
shell> mysql -uroot -p < world.sql
shell> mysql -uroot -p world
mysql> show tables;
+-----------------+
| Tables_in_world |
+-----------------+
| city            |
| country         |
| countrylanguage |
+-----------------+
```

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Exercise 5

Creating a database dump

A database dump is a logical backup of a database schema, a schema dump may or may not contain data. It can be valuable to create an empty schema dump when deploying new instances of a MySQL server, such as a Learning Management System or a Content Management System.

Creating a schema dump with data, triggers, stored procedures, and events:

```
shell> mysqldump -uroot -p --triggers --routines --events world > world_backup.sql
```

Creating a schema dump without data, but including triggers, stored procedures, and events:

```
shell> mysqldump -uroot -p --triggers --routines --events --no-data world > world_schema.sql
```

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Exercise 6

Verifying a database dump

The previous example created a logical dump of a single database. The dump does not include `CREATE DATABASE` statements, so you must manually create a database before loading the dump. In this exercise we will use the `mysqldbcompare` utility to compare the dump with the original data.

Creating the database and loading the dump:

```
mysql> CREATE DATABASE world_copy;
mysql> use world_copy;
mysql> source world_backup.sql
```

The `mysqldbcompare` utility is part of MySQL Utilities, an open source suite of utilities for managing MySQL databases. The MySQL Utilities are a Swiss-Army-Knife of tools that every DBA should have in their back pocket.

We will use the `mysqldbcompare` utility to perform a logical comparison of the original `world` database and the `world_copy` database. The `mysqldbcompare` utility can find schema and row differences between 2 databases, however it can be quite slow in a production environment with lots of data.

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Exercise 6.1

Verifying a database dump

Using mysqldbcompare to verify the backup with the original data:

```
shell> mysqldbcompare  --server1=root:Oracle1*@localhost world:world_copy
# WARNING: Using a password on the command line interface can be insecure.
# server1 on localhost: ... connected.
# Checking databases world and world_copy on server1
#
#                                                  Defn    Row     Data
# Type      Object Name                            Diff    Count   Check
# ------------------------------------------------------------------------
# TABLE     city                                   pass    pass    -
#           - Compare table checksum                                FAIL
#           - Find row differences                                  pass
# TABLE     country                                pass    pass    -
#           - Compare table checksum                                FAIL
#           - Find row differences                                  pass
# TABLE     countrylanguage                        pass    pass    -
#           - Compare table checksum                                FAIL
#           - Find row differences                                  pass

# Databases are consistent.
#
# ...done
```

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Exercise 7

Creating a full logical backup

There are several backup options for MySQL, one of the oldest and simplest is mysqldump. This tool is often used for backing up individual databases or making a full server backup. This exercise shows you how to make a full dump of the database instance.

Creating a dump of all databases with data, triggers, stored procedures, and events:

```
shell> mysqldump -uroot -p --triggers --routines --events \
--add-drop-database --all-databases > full_backup.sql
```

A full logical dump can be useful for backing up servers without a lot of data, or in cases of disk corruption, dumping and reloading the data in order to eliminate corruption. The above example dump includes `DROP DATABASE` statements to permit loading the dump into a server where tables already exist. This eliminates needing to manually drop all databases from the server. The `--all-databases` option ignores the following databases: `sys`, `information_schema`, and `performance_schema`

Loading the above dump is similar to previous exercises:

```
shell> mysql -uroot -p < full_backup.sql
```

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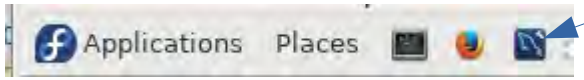
Exercise 8

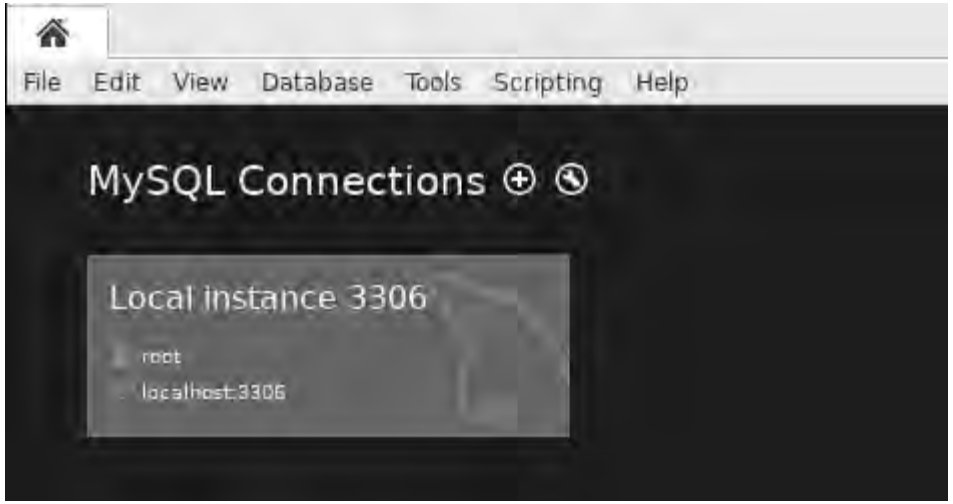
Introducing MySQL Workbench

MySQL Workbench is a graphical environment for managing MySQL servers, querying, and developing SQL schemas.

To launch MySQL Workbench, click on the blue dolphin icon:



After launching you are presented with a list of connections. The local server is automatically detected and displayed. Click on the **Local Instance** connection to open the Query tab.



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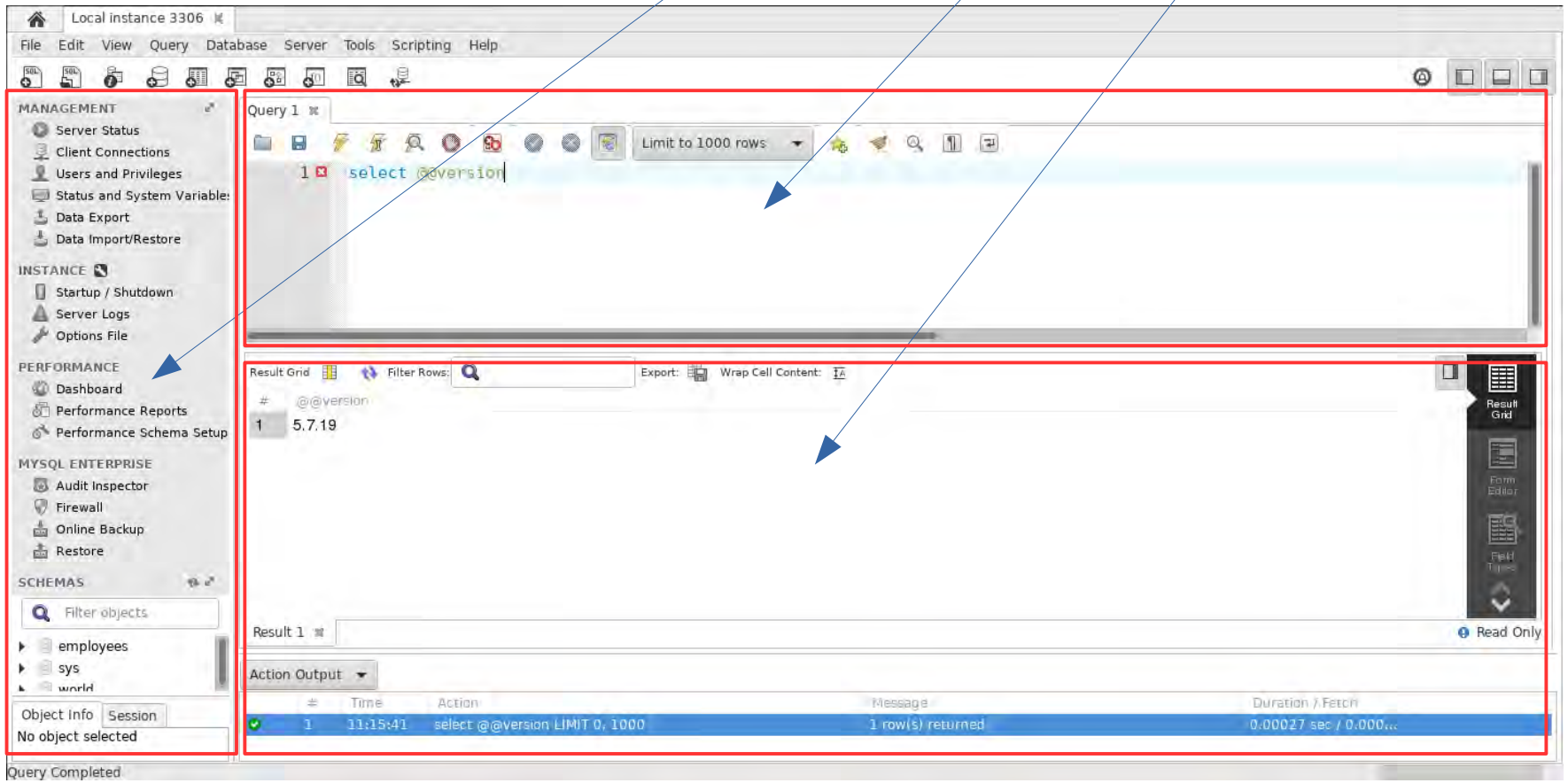
Exercise 8.1

Introducing MySQL Workbench

There are 3 main parts of the query tab: Management and Schemas, Query, and Output



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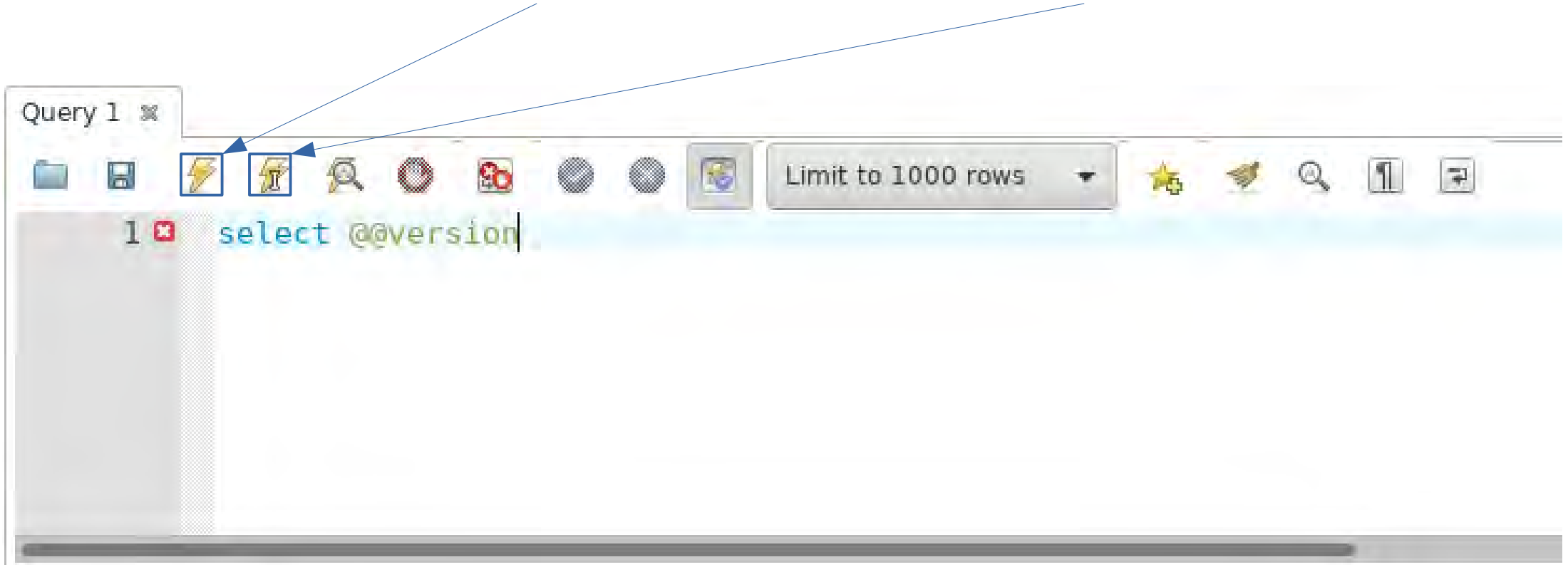
Exercise 8.2

Introducing MySQL Workbench

MySQL Workbench allows you to execute adhoc queries just as you would in the MySQL Client. The Query section of the tab allows you to enter and execute queries.

You can execute selected queries, all queries in the window, or just the query your cursor is on.



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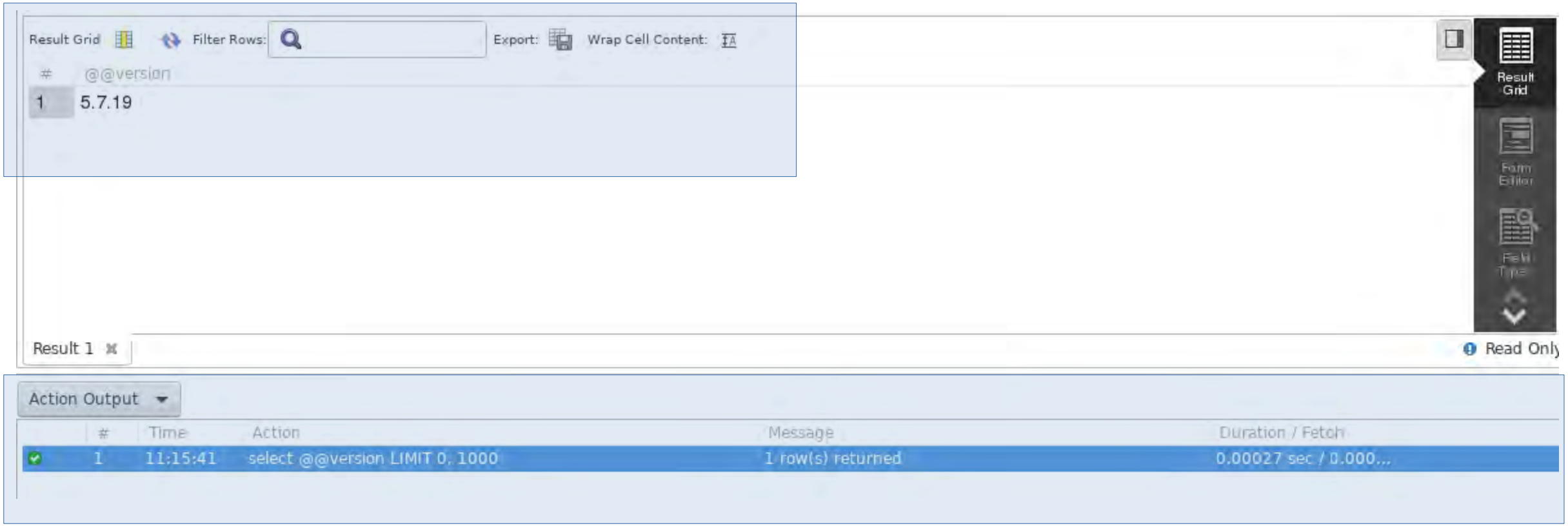
Exercise 8.3

Introducing MySQL Workbench

After executing a query, the results are displayed in a tabular format in the output pane. The lower portion of the output contains the execution time, row count, and warning information.



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Exercise 9

Backup with MySQL Enterprise Backup

MySQL Enterprise Backup can be used standalone, or in conjunction with MySQL Workbench. This exercise shows you how to make a backup with MySQL Workbench. The Server connection must first be configured to tell Workbench what type of OS you have, so it knows what commands to use to start/stop MySQL and where the `my.cnf` is. The **Installation Type** for the **Local instance** must be set to **RHEL 7 (MySQL Package)**. Once set, click the **Close** button.

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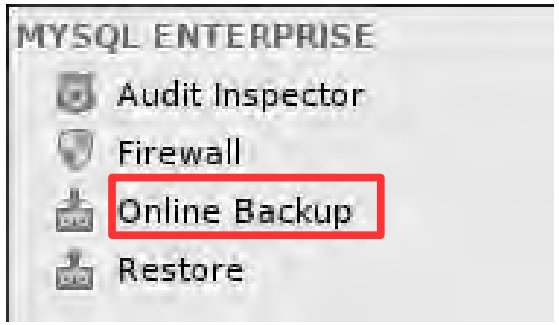
Exercise 9.1

Backup with MySQL Enterprise Backup

Next we need to configure MySQL Enterprise Backup.

Click on **Online Backup** in the **MYSQL ENTERPRISE** section of the **MANAGEMENT** pane:



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Exercise 9.2

Backup with MySQL Enterprise Backup

1) For the command path, enter:

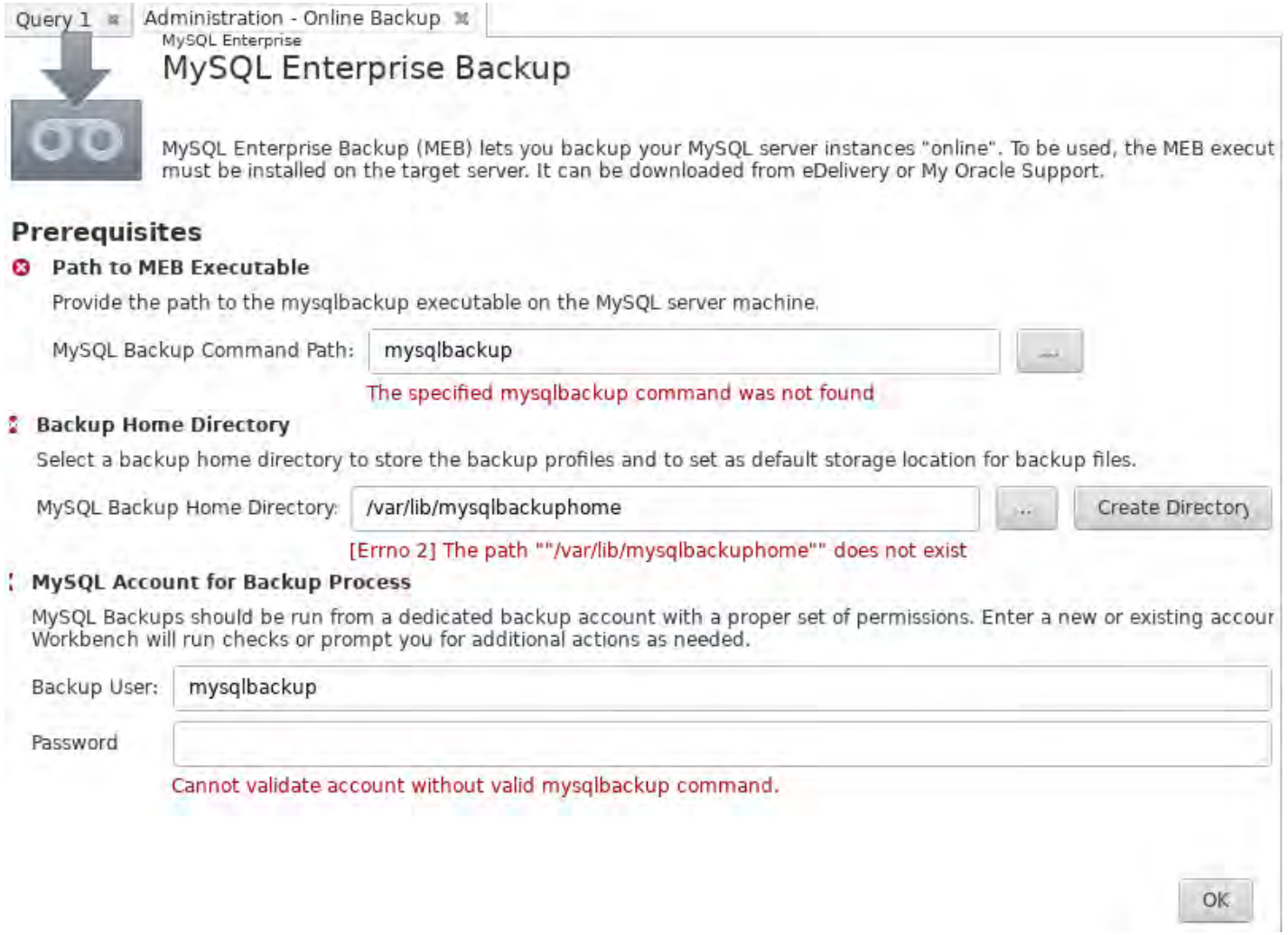
```
/opt/mysql/meb-4.1/bin/mysqlbackup
```

2) Next click **Create Directory**

3) Then click **Create MEB Account...**

4) For the password popup, use **Oracle1***

5) Click **OK** to finish the setup procedure



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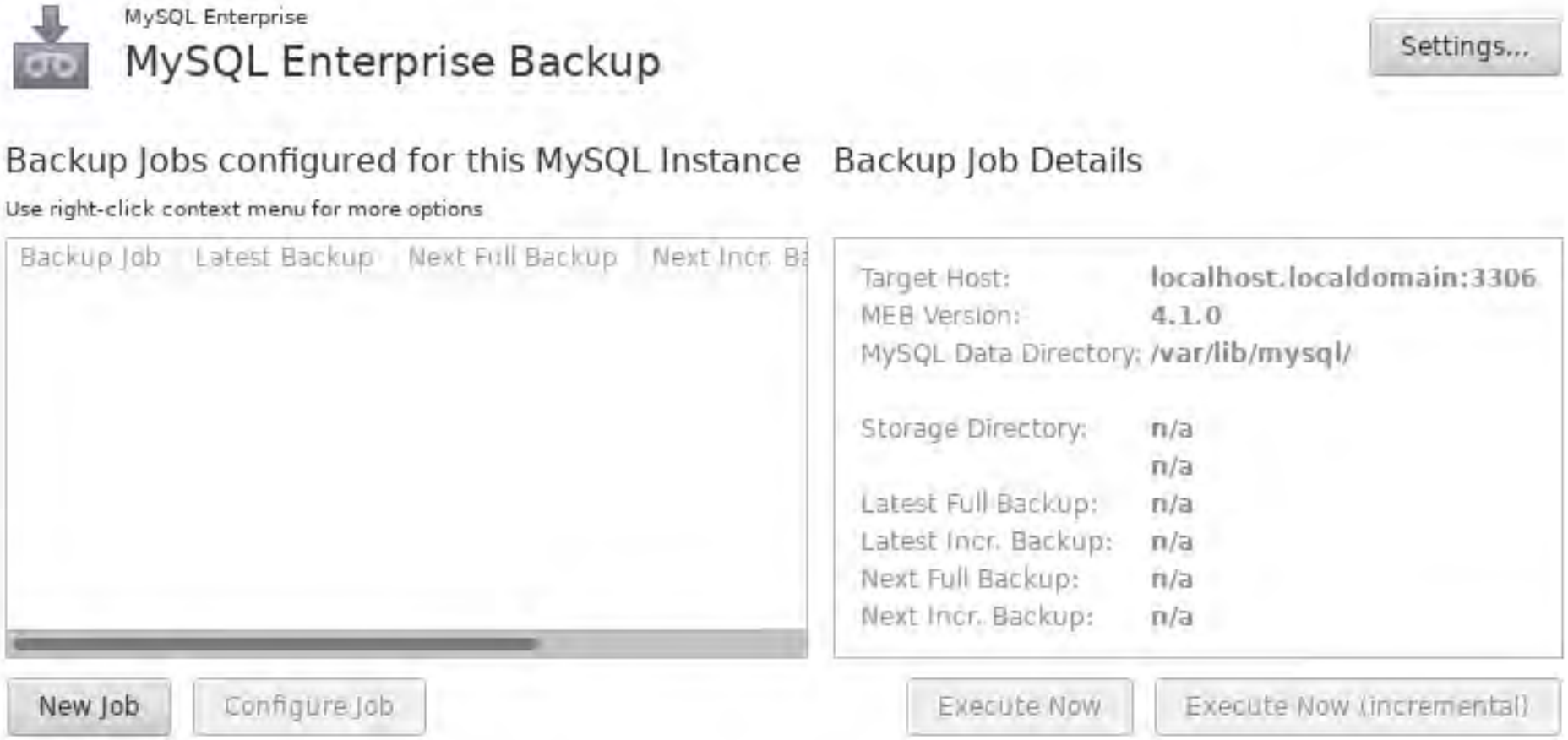
Exercise 9.3

Backup with MySQL Enterprise Backup

Once setup, you are presented with the job screen. To create a new backup, click on **New Job**.



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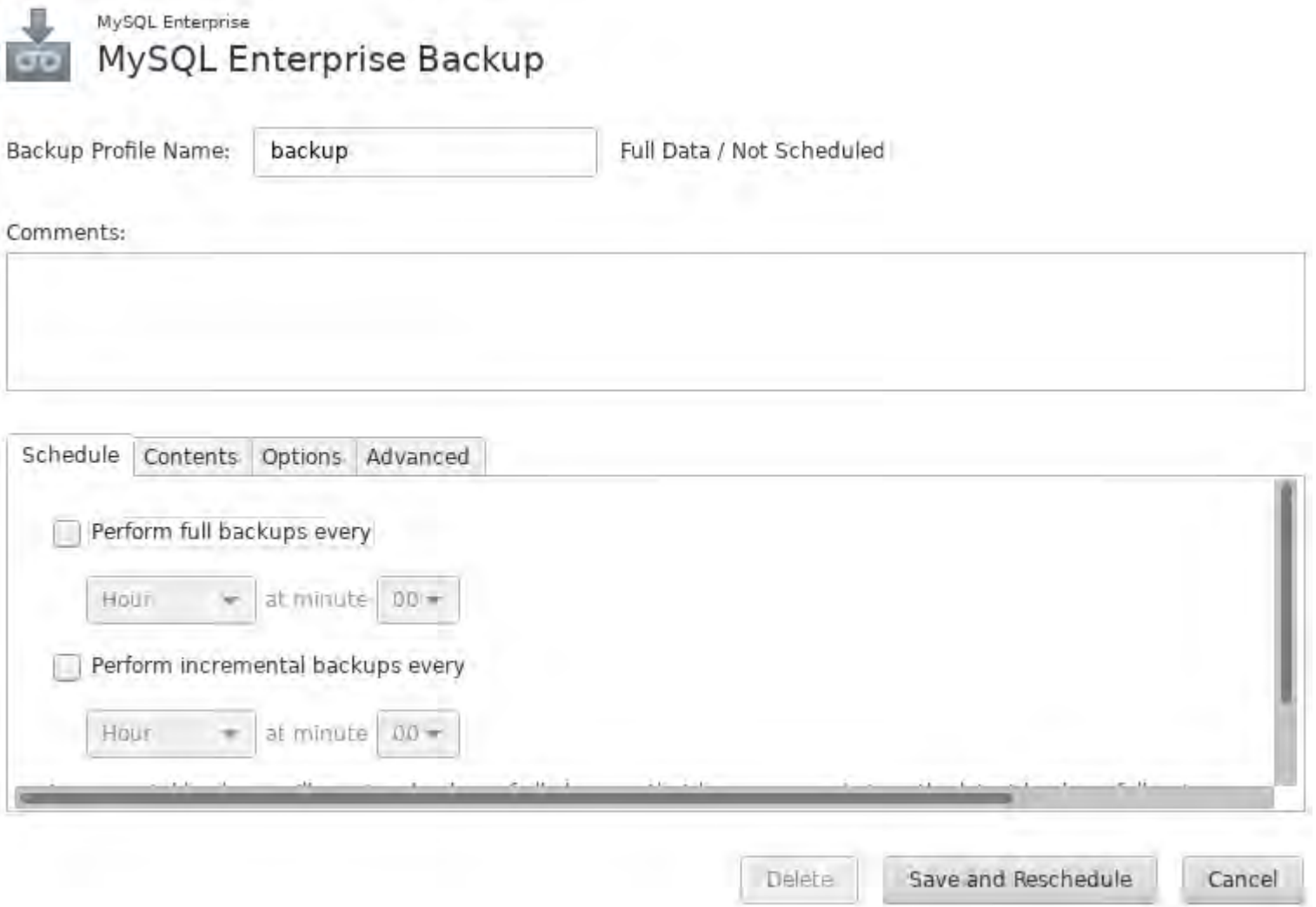
Exercise 9.4

Backup with MySQL Enterprise Backup

1) Click **Perform full backups every**
2) Choose **Day** from the list
3) Click **Save and Reschedule**
4) Click **Create** when prompted



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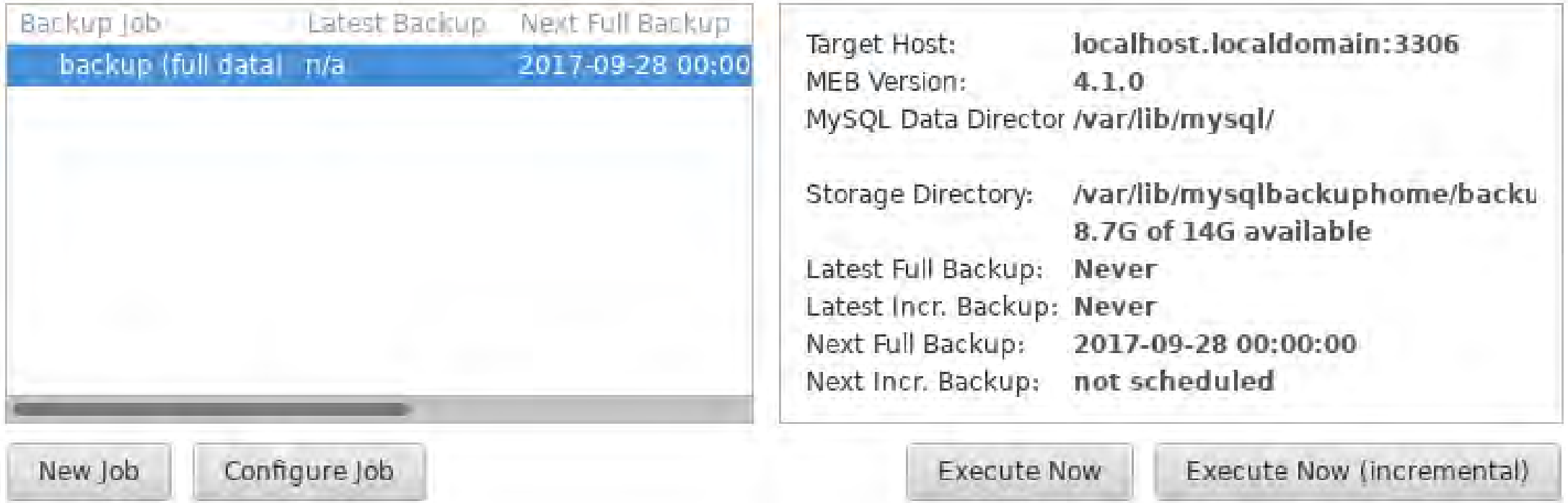
Exercise 9.5

Backup with MySQL Enterprise Backup

You should now see a backup job in the list on the left. To begin the backup now, click **Execute Now**.



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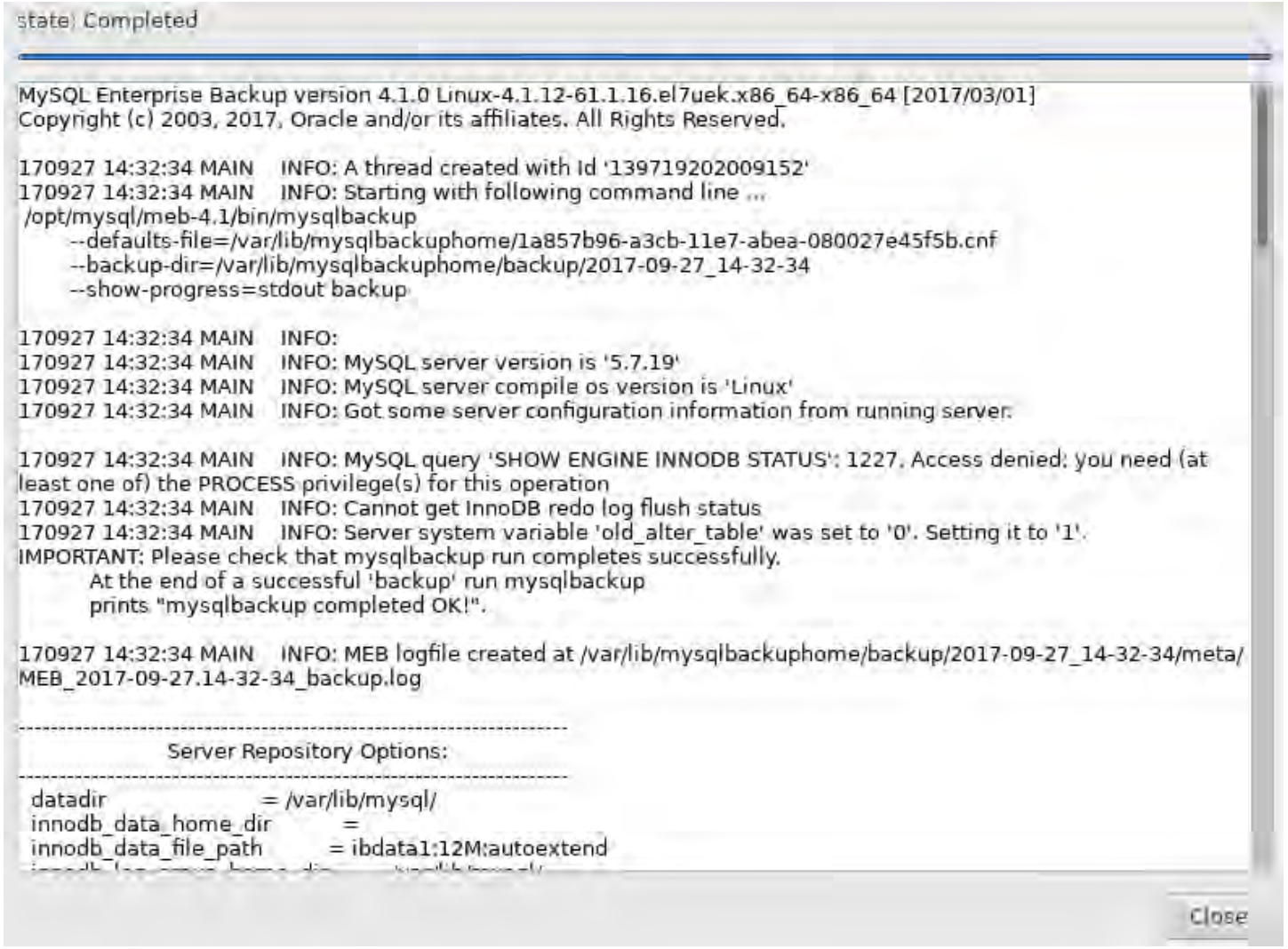
Exercise 9.6

Backup with MySQL Enterprise Backup

When the backup executes, you will see a window like the one to the right.

When complete, the window will have **state: Completed** at the top, and a full output of MySQL Enterprise Backup will be displayed in a scrolling text viewer.

Click **Close** to dismiss this window.



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Exercise 9.7

Backup with MySQL Enterprise Backup

Once you've completed a backup, you will see the most recent run in the **Recent Activity** pane of the tab:

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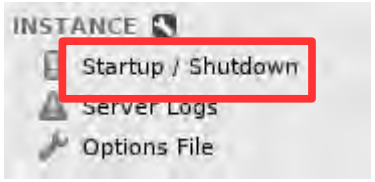
Exercise 10

Restore with MySQL Enterprise Backup

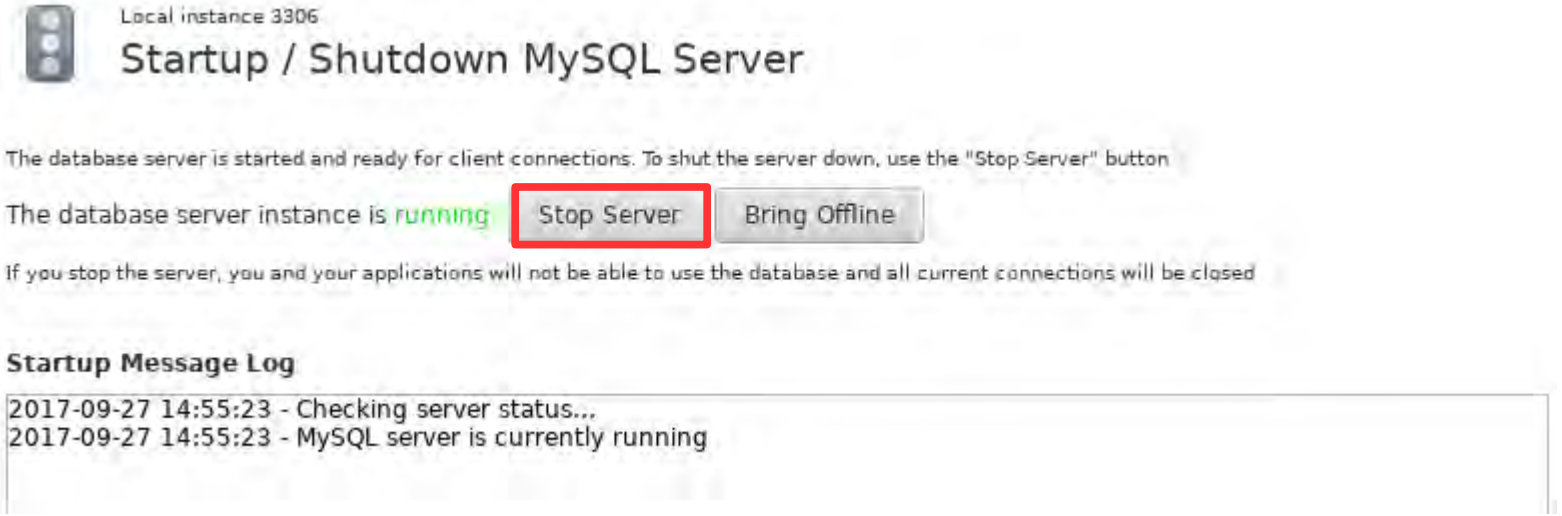
Now that we've made a backup, let's use MySQL Workbench to restore the backup.

Before restoring a backup, we must stop the server and prepare it for the restore.

Click on **Startup / Shutdown** in the **INSTANCE** section of the **MANAGEMENT** pane:



Now click **Stop Server** to stop MySQL



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Exercise 10.1

Restore with MySQL Enterprise Backup

Once the server is stopped, we need to remove the data files because MySQL Enterprise Backup requires an empty datadir to restore to:

```
shell> sudo rm -rf /var/lib/mysql/*
```

WARNING: This command is very powerful, if you are not careful, you can accidentally remove your data **PERMANENTLY!**

When performing restore operations it is good practice to dedicate uninterrupted time to focus on the task so that you do not skip steps or make mistakes. This is one of the few times that a mistake can be unrecoverable in the wrong circumstances.

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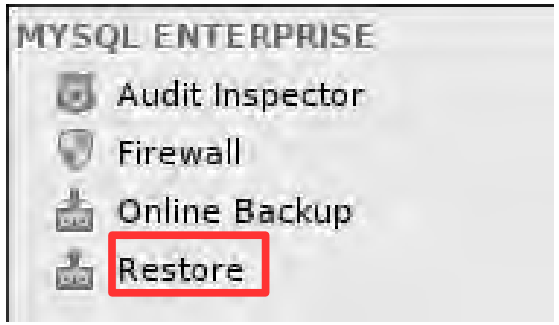
Exercise 10.2

Restore with MySQL Enterprise Backup

Once the server is stopped, we can begin the restoration process.

Click on **Restore** in the **MYSQL ENTERPRISE** section of the **MANAGEMENT** pane:



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Exercise 10.3

Restore with MySQL Enterprise Backup

After clicking Restore, you will be prompted to choose from several restore option, choose **Restore based on a Backup Profile configured on this server**, then click **Next >**

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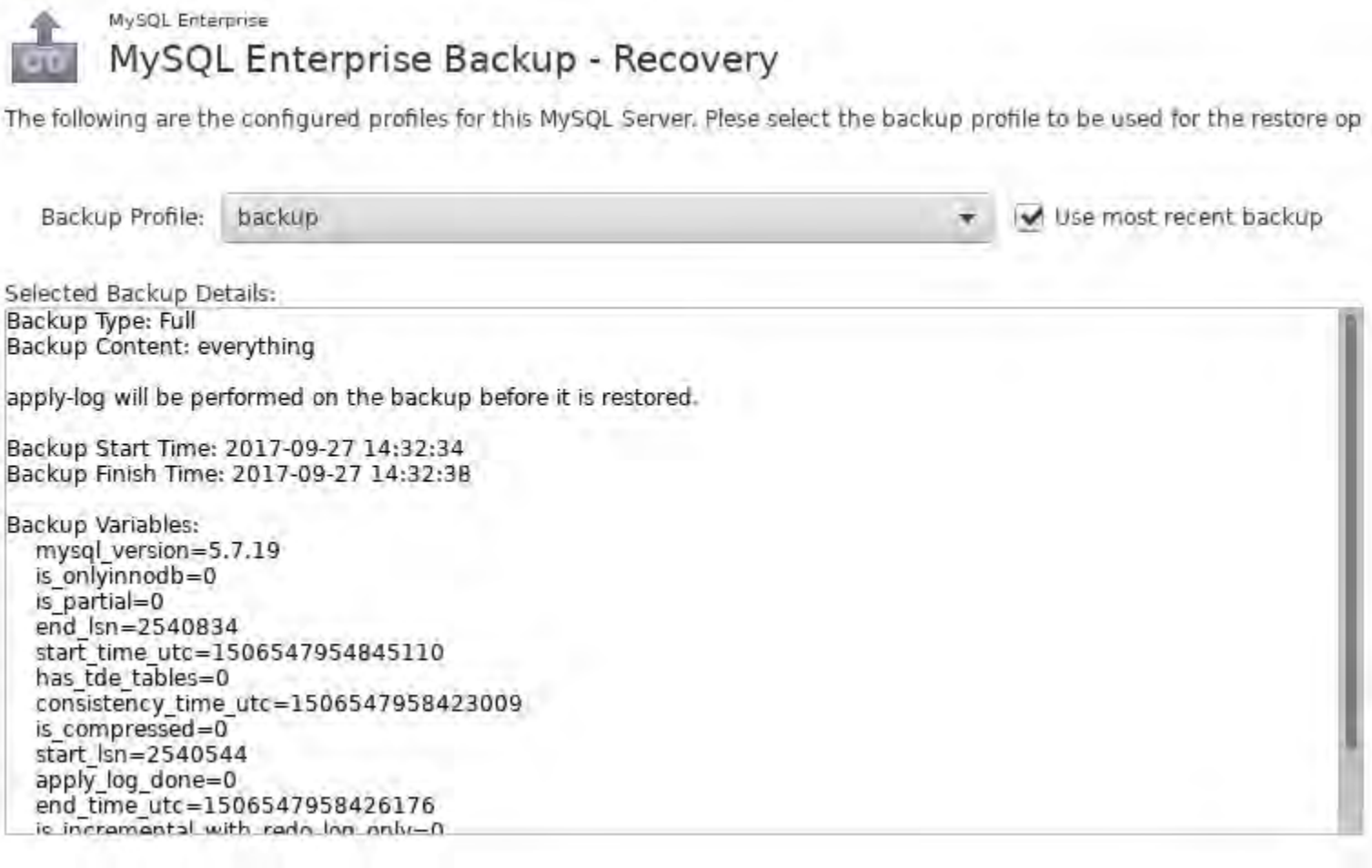
Exercise 10.4

Restore with MySQL Enterprise Backup

You will be presented with a list of **Backup Profiles**, since we only have one, click **Next >**



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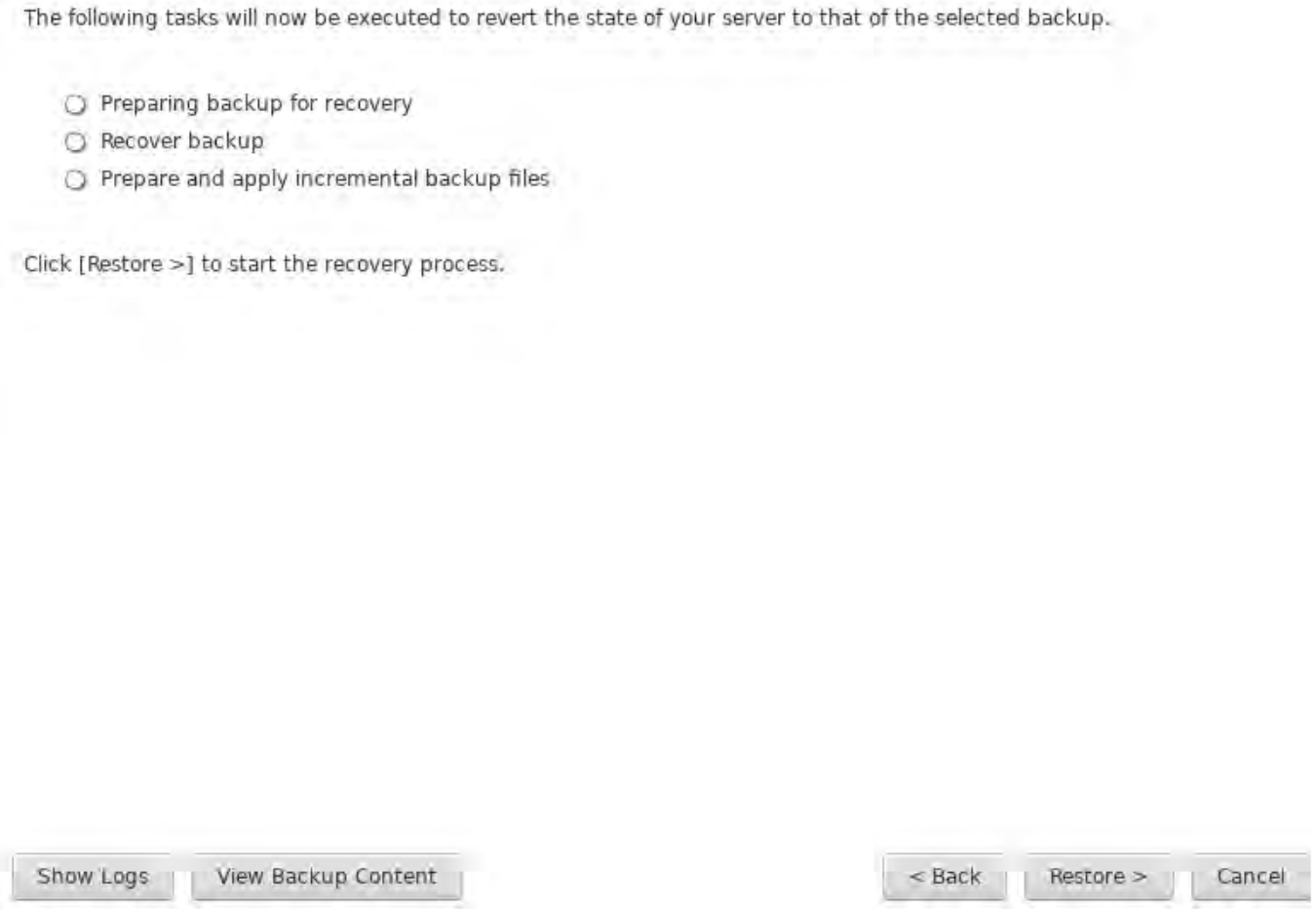
Exercise 10.5

Restore with MySQL Enterprise Backup

Before the restore is started, MySQL Workbench will display the following preparatory information:

1) Click **Restore >** to proceed
2) Click **Restore** when prompted by the popup



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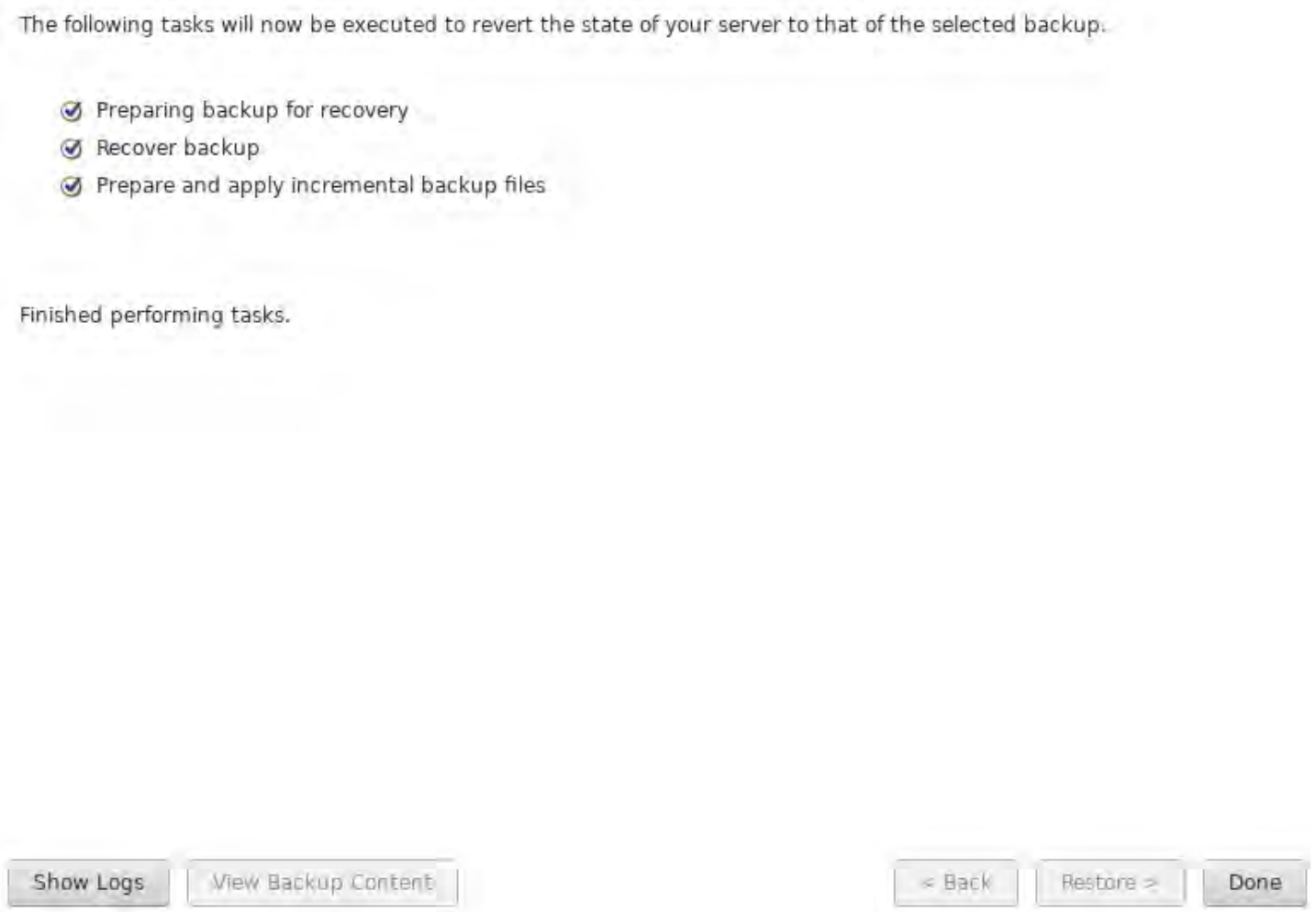
Exercise 10.6

Restore with MySQL Enterprise Backup

When the restore is complete you will see a screen like this:

When complete, click **Done** to dismiss



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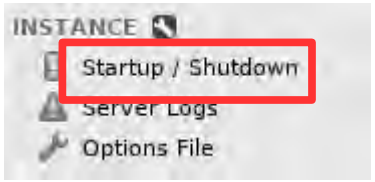
Exercise 10.7

Restore with MySQL Enterprise Backup

The final step of a restore is to start the server.

Click on **Startup / Shutdown** in the **INSTANCE** section of the **MANAGEMENT** pane:



Now click **Start Server** to start MySQL

When complete, you will be prompted to login to the server as root@localhost

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Recommended Conference Sessions

HOL7299: **MySQL Performance Tuning 101**
Tuesday, Oct 03, 11:30 a.m. - 12:30 p.m.
Hilton San Francisco Union Square (Ballroom Level) - Continental Ballroom 7

HOL7297: **Solving Performance Problems with MySQL Enterprise Monitor**
Wednesday, Oct 04, 4:45 p.m. - 5:45 p.m. | Hilton San Francisco Union Square (Ballroom Level) - Continental Ballroom 7

HOL7316: **MySQL InnoDB Cluster in a Nutshell**
Monday, Oct 02, 4:15 p.m. - 5:15 p.m. | Hilton San Francisco Union Square (Ballroom Level) - Continental Ballroom 7

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