

OpenWorld 2017

HOL7298

MySQL DBA Primer

Perry Harrington
Principal Technical Support Engineer
MySQL Support Group
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WORLD

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Safe Harbor Statement

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HOL7298: MySQL DBA Primer



MySQL™

Topics

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

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?

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?

Connections

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

Connections²

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

High Availability

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

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!

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

Backing up your data

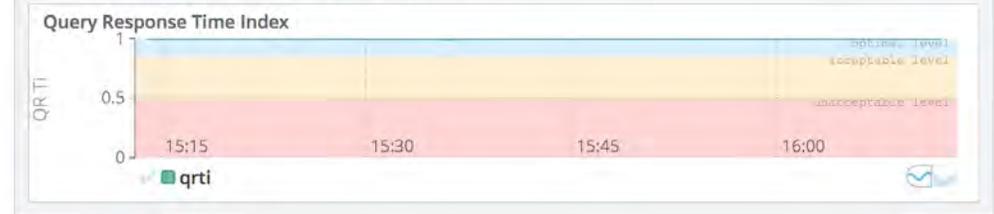
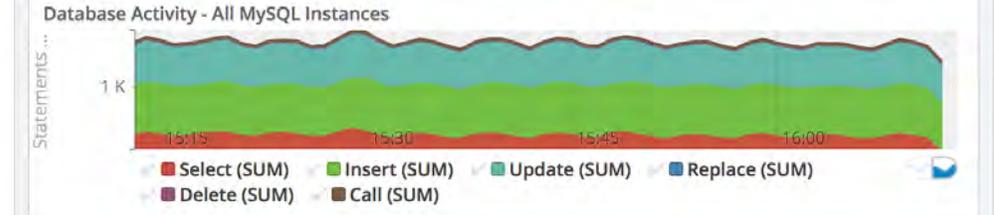
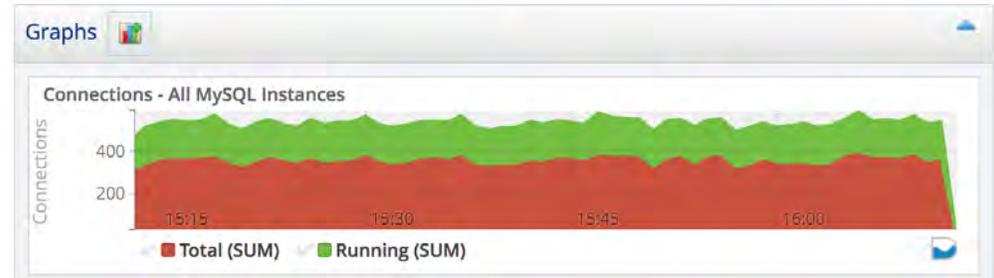
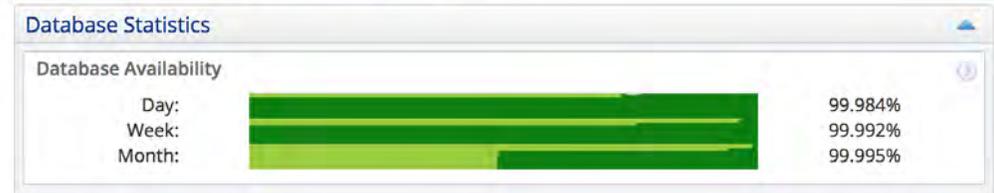
- `mysqldump`
 - Logical dump
 - Compatible with `mysqldump`
 - Parallel table processing
 - Faster loading by creating indexes at end of table load
 - Dumping of user GRANTS
 - Compressed dumps
 - 5.7 only
 - Can take system lock without `-single-transaction`
 - Requires system lock for MyISAM tables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

Monitoring

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

Dashboard

All group - Graphs for last 1 hour (UTC) Edit



Current Problem MySQL Instances

ID	Status	Emergency	Critical	Warning
grsr2n1:3306	Up	0	1	14
grsr2n3:3306	Up	0	1	13
grsr2n2:3306	Up	0	1	12

Showing 1 to 3 of 3 entries

Current Problem Hosts

ID	Status	Emergency	Critical	Warning
vitan06	Up	0	11	12

Showing 1 to 1 of 1 entries

Current Emergency & Critical Events

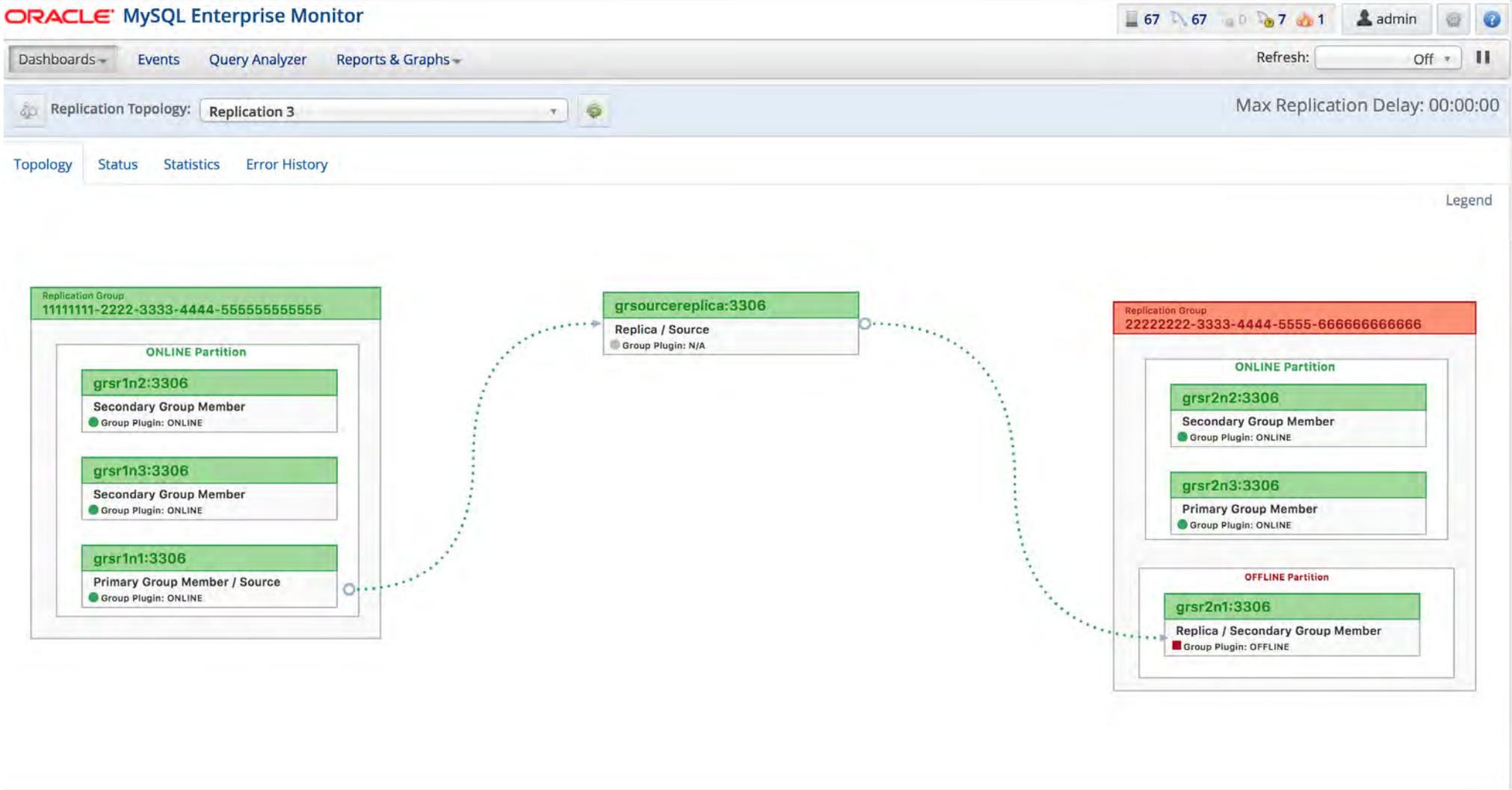
Show 5 entries

Subject	Topic	Time	Actions
vitan06, /export/home/iro...	Filesystem /export/home/...	less than a minute ago	✖
vitan06, /var/share (rpool/...	Filesystem /var/share (rp...	less than a minute ago	✖
vitan06, /rpool/export (rpo...	Filesystem /rpool/export (...	less than a minute ago	✖
vitan06, / (rpool/ROOT/S11...	Filesystem / (rpool/ROOT/...	less than a minute ago	✖
vitan06, /system/zones (rp...	Filesystem /system/zones...	less than a minute ago	✖

Showing 1 to 5 of 12 entries



Replication Topology



Replication Status

ORACLE MySQL Enterprise Monitor

67 67 0 7 1 admin

Dashboards Events Query Analyzer Reports & Graphs

Refresh: Off

Replication Topology: Replication 3

Max Replication Delay: 00:00:00

Topology Status Statistics Error History

GR:22222222-3333 : Group Replication has Members OFFLINE. Tolerant to 0 node failures. Group has Quorum.

GR:11111111-2222 : All Group Replication Members are ONLINE. Tolerant to 1 node failures. Group has Quorum.

Show All entries

Search:

Show / hide columns

First Previous 1 Next Last

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	Version
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

Showing 1 to 7 of 7 entries

First Previous 1 Next Last

Backups

The screenshot shows the Oracle Enterprise Manager Instance Backup Overview page for instance `web-db-1`. The left-hand navigation pane shows a tree structure with `web-db-1` selected under the `Web Tier`. The main content area is titled "Instance Backup Overview" and includes filters for `End Time`, `Interval` (set to 1 Week), `Type` (Any), and `Exit State` (Any). There are also buttons for `Filter` and `Reset to Default`. Below the filters are tabs for `Overview` and `History`. The `Overview` tab displays a "Backup Events" summary with four categories: `Emergency` (0), `Critical` (0), `Warning` (0), and `Notice` (1). The page is divided into two columns of backup details. The left column contains:

- Last Backup**: End Time: Sep 6, 2016 2:01:50 pm; Type: INCREMENTAL; Run Time: 1m 49s; Lock Time: 53s 15ms; End LSN: 242822337935; Binlog Position: MLEITH-GB-bin.000161 : 978110627; Exit State: SUCCESS.
- Last Successful Full Backup**: End Time: Sep 6, 2016 12:03:16 am; Run Time: 3m 16s; Lock Time: 17s 465ms; End LSN: 242421210978; Binlog Position: MLEITH-GB-bin.000161 : 757143943.
- Backup Run Time History**: A bar chart showing backup run times over time, with a summary value of `1m 49s`.

The right column contains:

- Last Failed Backup** (highlighted in red): End Time: Aug 24, 2016 8:00:05 am; Type: INCREMENTAL; Run Time: 5s; Lock Time: (binlog disabled); End LSN: 0; Binlog Position: (binlog disabled).
- Last Successful Incremental Backup**: End Time: Sep 6, 2016 2:01:50 pm; Run Time: 1m 49s; Lock Time: 53s 15ms; End LSN: 242822337935; Binlog Position: MLEITH-GB-bin.000161 : 978110627.
- Backup Lock Time History**: A bar chart showing backup lock times over time, with a summary value of `53s 15ms`.

QUAN

ORACLE MySQL Enterprise Monitor

46 57 5 28 1 demo Refresh: Off

Dashboards Events Query Analyzer Reports & Graphs

Browse Queries Show / hide columns

Graph From: 2015-10-13 23:38 To: 2015-10-13 23:41 (CEST) Edit

InnoDB OS File Access - Data (Individual)
Zoom: 1h 2h 4h 6h 12h 1d 2d

InnoDB OS File Access

Average Operatio...

file reads file writes file sync() redo log

Show 10 entries Export data options... Showing 1 to 10 of 34 entries First Previous 1 2 3 4 Next Last

Query	Database	Counts	QRTI	Latency (hh:mm:ss.ms)				Rows
				Exec	Err	Warn	Total	
SHOW GLOBAL VARIABLES	mysql	23 0 0	1.00	0.288	2:54.340	0.013	11'270	
SHOW VARIABLES LIKE ?	mysql	26 0 0	1.00	0.259	2.430	0.010	26	
SET SESSION 'sql_mode' = ?	mysql	377 0 756	1.00	0.160	49.986	0.000	0	
SHOW GLOBAL STATUS	mysql	16 0 0	1.00	0.133	20.418	0.008	5'648	
SELECT @@SESSION . 'sql_mode'	mysql	357 0 0	1.00	0.125	1:45.342	0.000	357	
SELECT * FROM (SELECT ...S 'noIndexUsedCount' ,	mysql	6 0 0	1.00	0.123	37.884	0.021	218	
SELECT COUNT (*) FROM... = ? AND TABLE_NAME = ?	mysql	78 0 0	1.00	0.122	57.558	0.002	78	
SELECT CAST ('SUM_NUMB...VENT_NAME' = ? LIMIT ?	mysql	15 0 0	1.00	0.082	14.381	0.005	15	
SHOW GLOBAL VARIABLES W...OR 'Variable_name' = ?	mysql	6 0 0	1.00	0.079	23.901	0.013	18	
SELECT 'ROUND' (SUM (...ary_by_digest' LIMIT ?	mysql	6 0 0	1.00	0.074	7.619	0.012	6	

Export data options... First Previous 1 2 3 4 Next Last



HOL7298: MySQL DBA Primer

Exercises



MySQL™

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;
```

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**

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_AUTO_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
```

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 |
+-----+
```

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
```

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.

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
#
#
# Type      Object Name      Defn      Row      Data
#           Object Name      Diff      Count    Check
# -----
# TABLE    city              pass      pass     -
#           - Compare table checksum
#           - Find row differences
#           - Find row differences
# TABLE    country           pass      pass     -
#           - Compare table checksum
#           - Find row differences
#           - Find row differences
# TABLE    countrylanguage  pass      pass     -
#           - Compare table checksum
#           - Find row differences
#           - Find row differences

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

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:

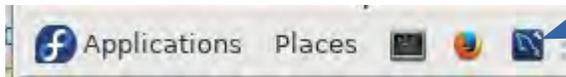
```
shell> mysql -uroot -p < full_backup.sql
```

Exercise 8

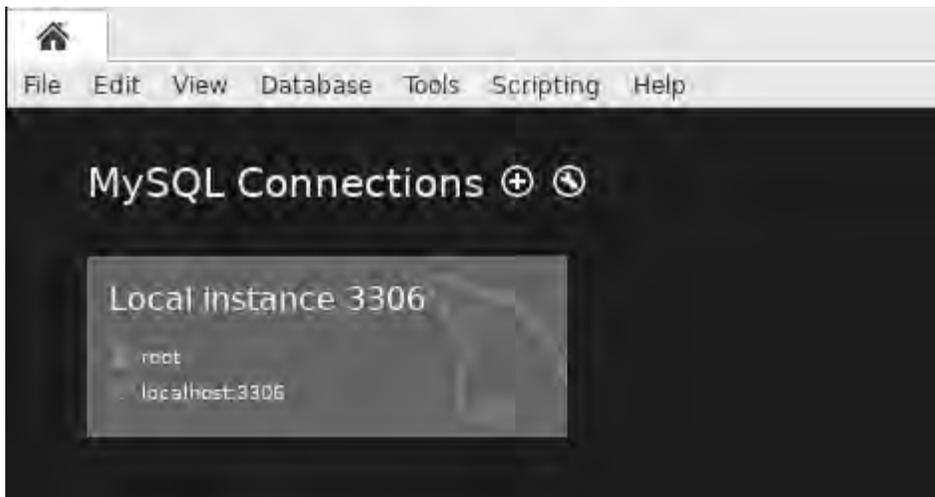
Introducing MySQL Workbench

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:



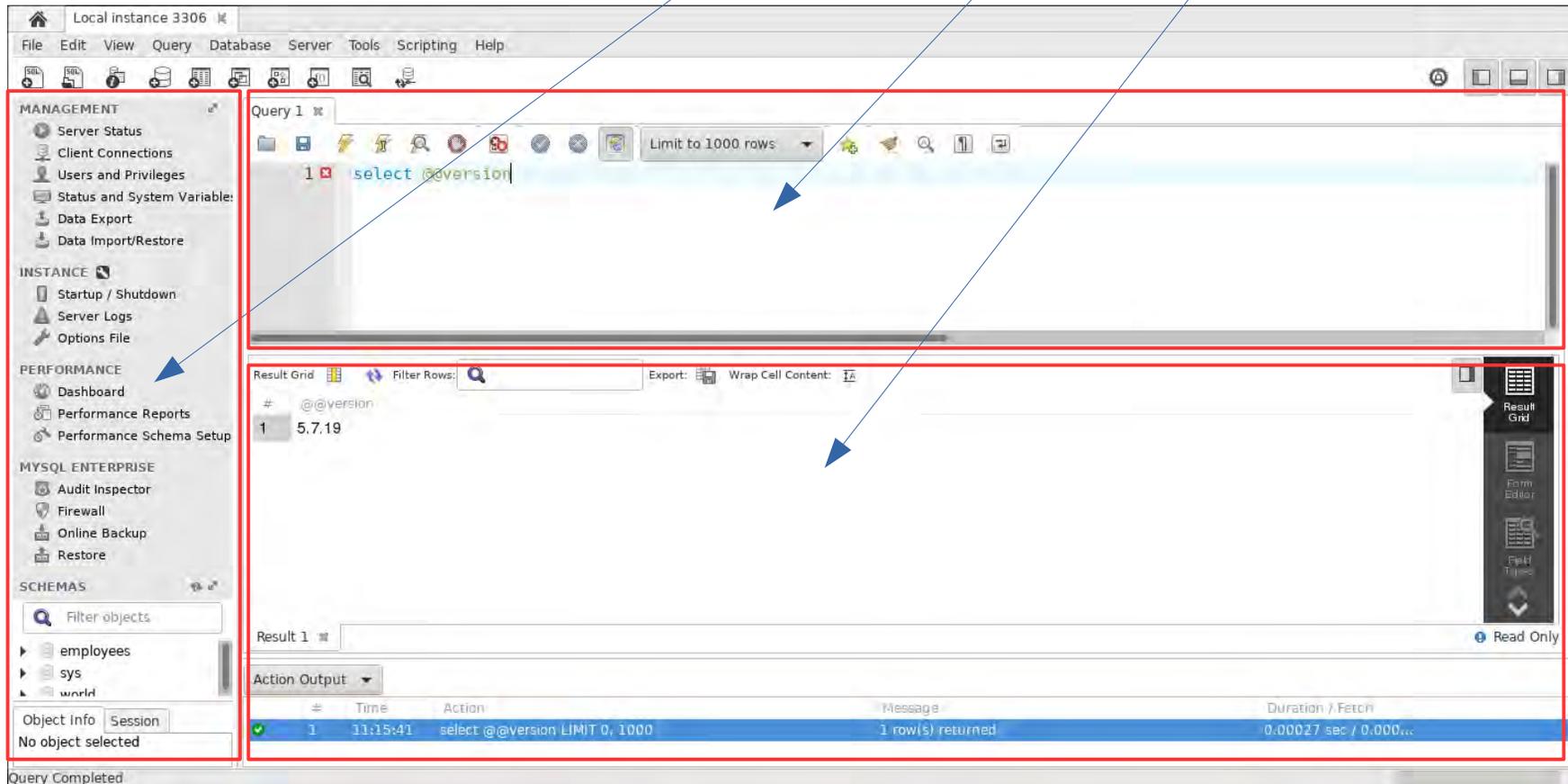
After launching you are presented with a list of connections. The local server is automatically detected and displayed. Click on the **Local Instance** connection to open the Query tab.



Exercise 8.1

Introducing MySQL Workbench

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

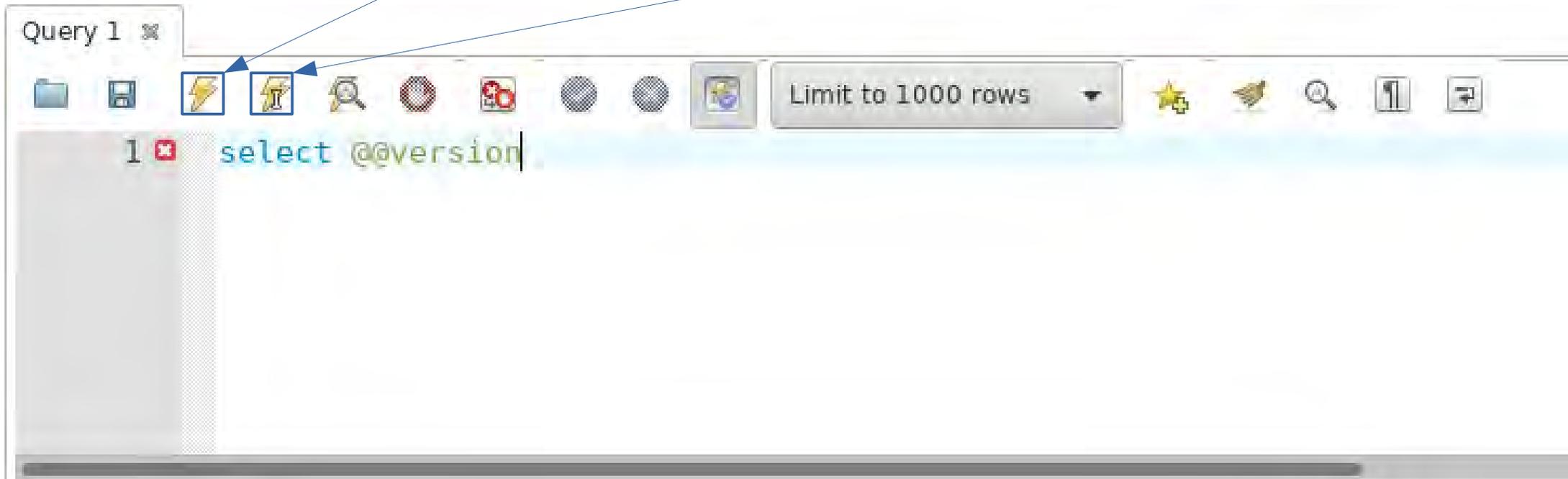


Exercise 8.2

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.



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.

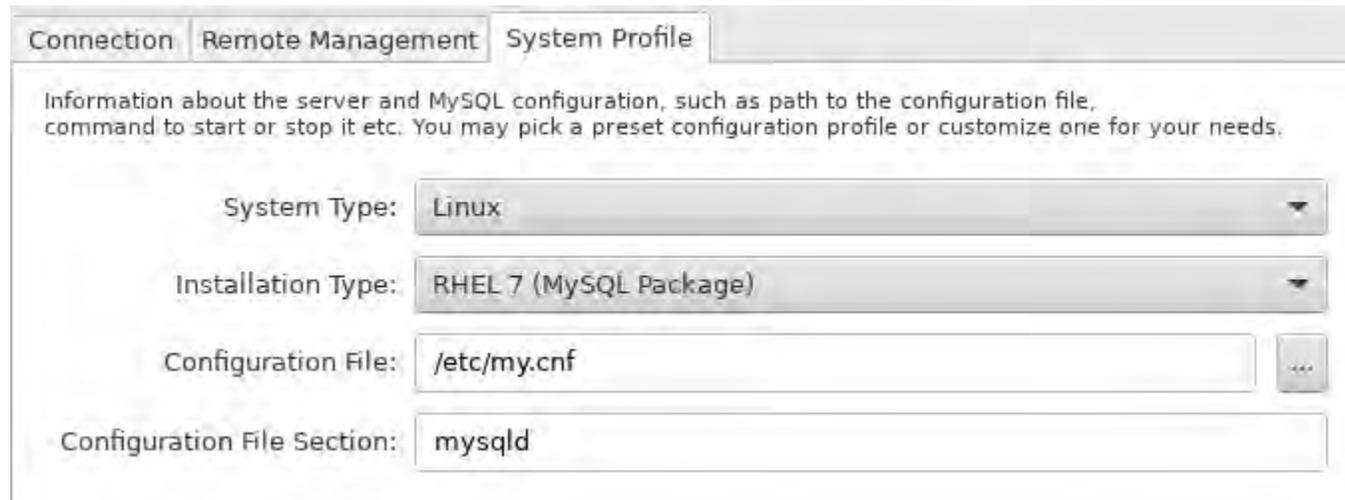
The screenshot displays the MySQL Workbench interface. The top pane, titled 'Result Grid', shows a single row of results for the query 'select @@version'. The row contains the number '1' in the first column and the version string '5.7.19' in the second column. The bottom pane, titled 'Action Output', shows the execution details for the query. It includes a table with columns for '#', 'Time', 'Action', 'Message', and 'Duration / Fetch'. The first row of the table indicates that the query was executed at 11:15:41, returned 1 row(s), and took 0.00027 seconds to execute.

#	Time	Action	Message	Duration / Fetch
1	11:15:41	select @@version LIMIT 0, 1000	1 row(s) returned	0.00027 sec / 0.000...

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.



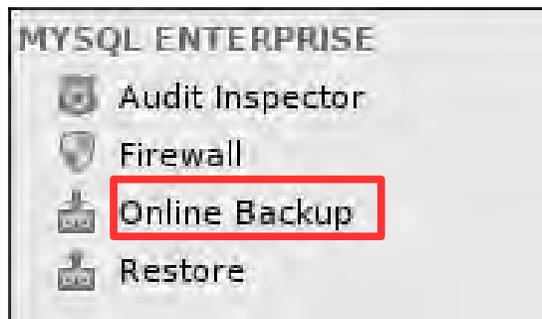
The screenshot shows the 'System Profile' tab of a configuration dialog in MySQL Workbench. The dialog has four tabs: 'Connection', 'Remote Management', 'System Profile', and an unlabeled tab. Below the tabs is a descriptive text: 'Information about the server and MySQL configuration, such as path to the configuration file, command to start or stop it etc. You may pick a preset configuration profile or customize one for your needs.' There are four configuration fields: 'System Type' is a dropdown menu set to 'Linux'; 'Installation Type' is a dropdown menu set to 'RHEL 7 (MySQL Package)'; 'Configuration File' is a text input field containing '/etc/my.cnf' with a browse button ('...') to its right; and 'Configuration File Section' is a text input field containing 'mysqld'.

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:



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

The screenshot shows the 'MySQL Enterprise Backup' configuration window. It has three tabs: 'Query 1', 'Administration - Online Backup', and 'MySQL Enterprise Backup'. The 'Administration - Online Backup' tab is active. The window title is 'MySQL Enterprise Backup'. Below the title is a description: 'MySQL Enterprise Backup (MEB) lets you backup your MySQL server instances "online". To be used, the MEB execut must be installed on the target server. It can be downloaded from eDelivery or My Oracle Support.'

Prerequisites

- Path to MEB Executable**
Provide the path to the mysqlbackup executable on the MySQL server machine.
MySQL Backup Command Path:
The specified mysqlbackup command was not found
- Backup Home Directory**
Select a backup home directory to store the backup profiles and to set as default storage location for backup files.
MySQL Backup Home Directory:
[Errno 2] The path ""/var/lib/mysqlbackuphome"" does not exist
- MySQL Account for Backup Process**
MySQL Backups should be run from a dedicated backup account with a proper set of permissions. Enter a new or existing account Workbench will run checks or prompt you for additional actions as needed.
Backup User:
Password:
Cannot validate account without valid mysqlbackup command.

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**.

The screenshot displays the MySQL Enterprise Backup management interface. At the top left, there is a MySQL logo with a downward arrow and the text "MySQL Enterprise" above "MySQL Enterprise Backup". A "Settings..." button is located at the top right. Below the header, the main area is split into two sections: "Backup Jobs configured for this MySQL Instance" and "Backup Job Details".

The "Backup Jobs" section contains a table with the following headers: "Backup Job", "Latest Backup", "Next Full Backup", and "Next Incr. Backup". The table is currently empty. Below the table is a "Use right-click context menu for more options" instruction. At the bottom of this section are two buttons: "New Job" and "Configure Job".

The "Backup Job Details" section shows the following configuration:

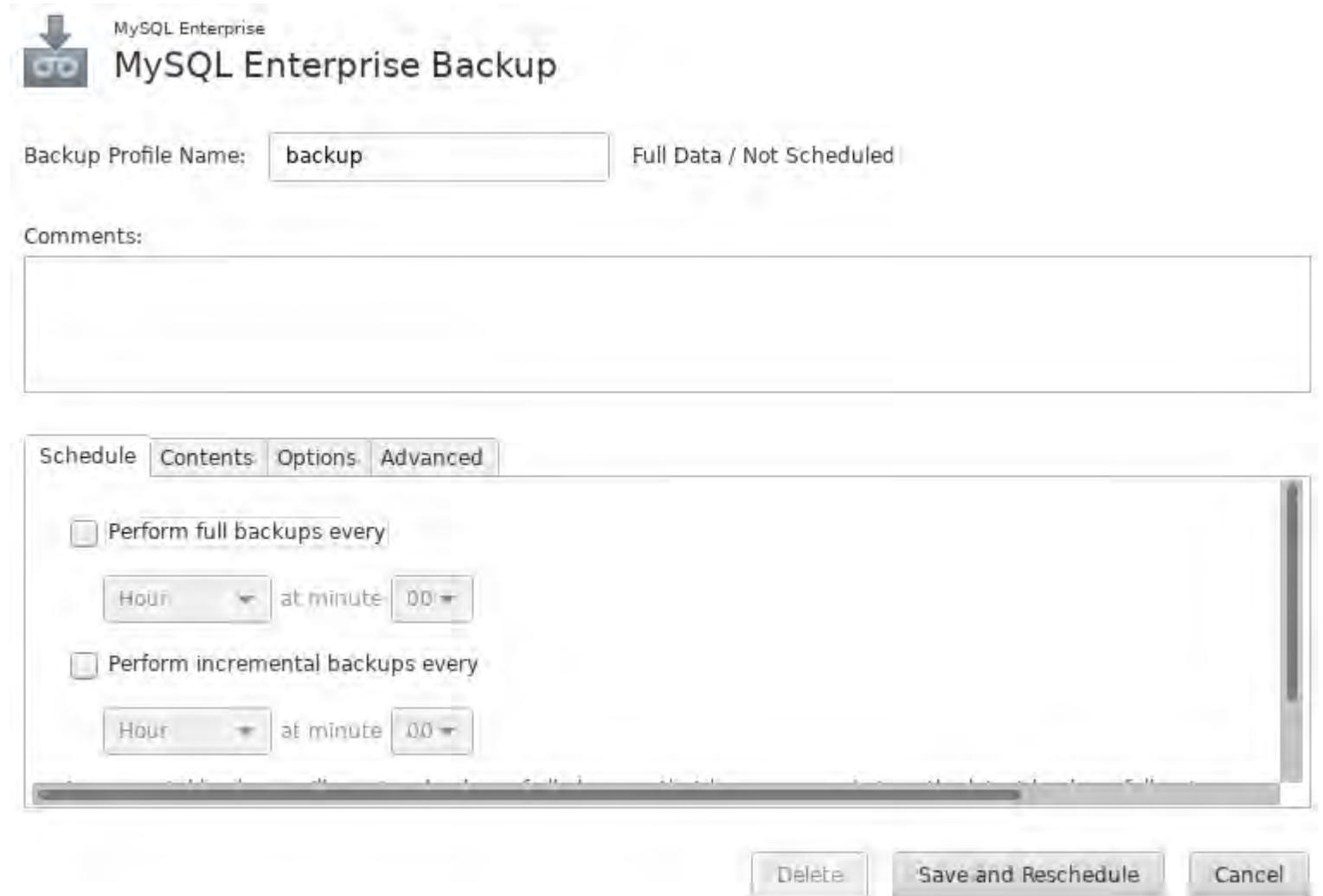
- Target Host: localhost.localdomain:3306
- MEB Version: 4.1.0
- MySQL Data Directory: /var/lib/mysql/
- Storage Directory: n/a
- Latest Full Backup: n/a
- Latest Incr. Backup: n/a
- Next Full Backup: n/a
- Next Incr. Backup: n/a

At the bottom of the details section are two buttons: "Execute Now" and "Execute Now (incremental)".

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



The screenshot shows the MySQL Enterprise Backup configuration window. At the top, there is a title bar with the MySQL Enterprise logo and the text "MySQL Enterprise Backup". Below the title bar, there is a "Backup Profile Name" field containing the text "backup" and a "Full Data / Not Scheduled" status indicator. A "Comments" text area is located below the profile name field. The main configuration area is divided into four tabs: "Schedule", "Contents", "Options", and "Advanced". The "Schedule" tab is currently selected. It contains two options, both with checkboxes: "Perform full backups every" and "Perform incremental backups every". Each option has a "Hour" dropdown menu and an "at minute" dropdown menu with "00" selected. At the bottom of the window, there are three buttons: "Delete", "Save and Reschedule", and "Cancel".

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**.

Backup Job	Latest Backup	Next Full Backup
backup (full data)	n/a	2017-09-28 00:00

Target Host:	localhost.localdomain:3306
MEB Version:	4.1.0
MySQL Data Director	/var/lib/mysql/
Storage Directory:	/var/lib/mysqlbackuphome/backu 8.7G of 14G available
Latest Full Backup:	Never
Latest Incr. Backup:	Never
Next Full Backup:	2017-09-28 00:00:00
Next Incr. Backup:	not scheduled

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.

```
state) Completed

MySQL Enterprise Backup version 4.1.0 Linux-4.1.12-61.1.16.el7uek.x86_64-x86_64 [2017/03/01]
Copyright (c) 2003, 2017, Oracle and/or its affiliates. All Rights Reserved.

170927 14:32:34 MAIN INFO: A thread created with Id '139719202009152'
170927 14:32:34 MAIN INFO: Starting with following command line ...
/opt/mysql/meb-4.1/bin/mysqlbackup
--defaults-file=/var/lib/mysqlbackuphome/1a857b96-a3cb-11e7-abea-080027e45f5b.cnf
--backup-dir=/var/lib/mysqlbackuphome/backup/2017-09-27_14-32-34
--show-progress=stdout backup

170927 14:32:34 MAIN INFO:
170927 14:32:34 MAIN INFO: MySQL server version is '5.7.19'
170927 14:32:34 MAIN INFO: MySQL server compile os version is 'Linux'
170927 14:32:34 MAIN INFO: Got some server configuration information from running server:

170927 14:32:34 MAIN INFO: MySQL query 'SHOW ENGINE INNODB STATUS': 1227. Access denied: you need (at
least one of) the PROCESS privilege(s) for this operation
170927 14:32:34 MAIN INFO: Cannot get InnoDB redo log flush status
170927 14:32:34 MAIN INFO: Server system variable 'old_alter_table' was set to '0'. Setting it to '1'.
IMPORTANT: Please check that mysqlbackup run completes successfully.
At the end of a successful 'backup' run mysqlbackup
prints "mysqlbackup completed OK!".

170927 14:32:34 MAIN INFO: MEB logfile created at /var/lib/mysqlbackuphome/backup/2017-09-27_14-32-34/meta/
MEB_2017-09-27.14-32-34_backup.log

-----
Server Repository Options:
-----
datadir = /var/lib/mysql/
innodb_data_home_dir =
innodb_data_file_path = ibdata1:12M:autoextend
innodb_log_group_home_dir = /var/lib/mysql/

Close
```

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:

Recent Activity						
Job	Type	Format	Status	Start Time	End Time	Total Time
backup	FULL	DIRECTORY	✔ SUCCESS	2017-09-27 14:32:34	2017-09-27 14:32:38	4s

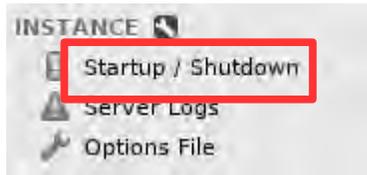
Exercise 10

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



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.

Exercise 10.2

Restore with MySQL Enterprise Backup

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

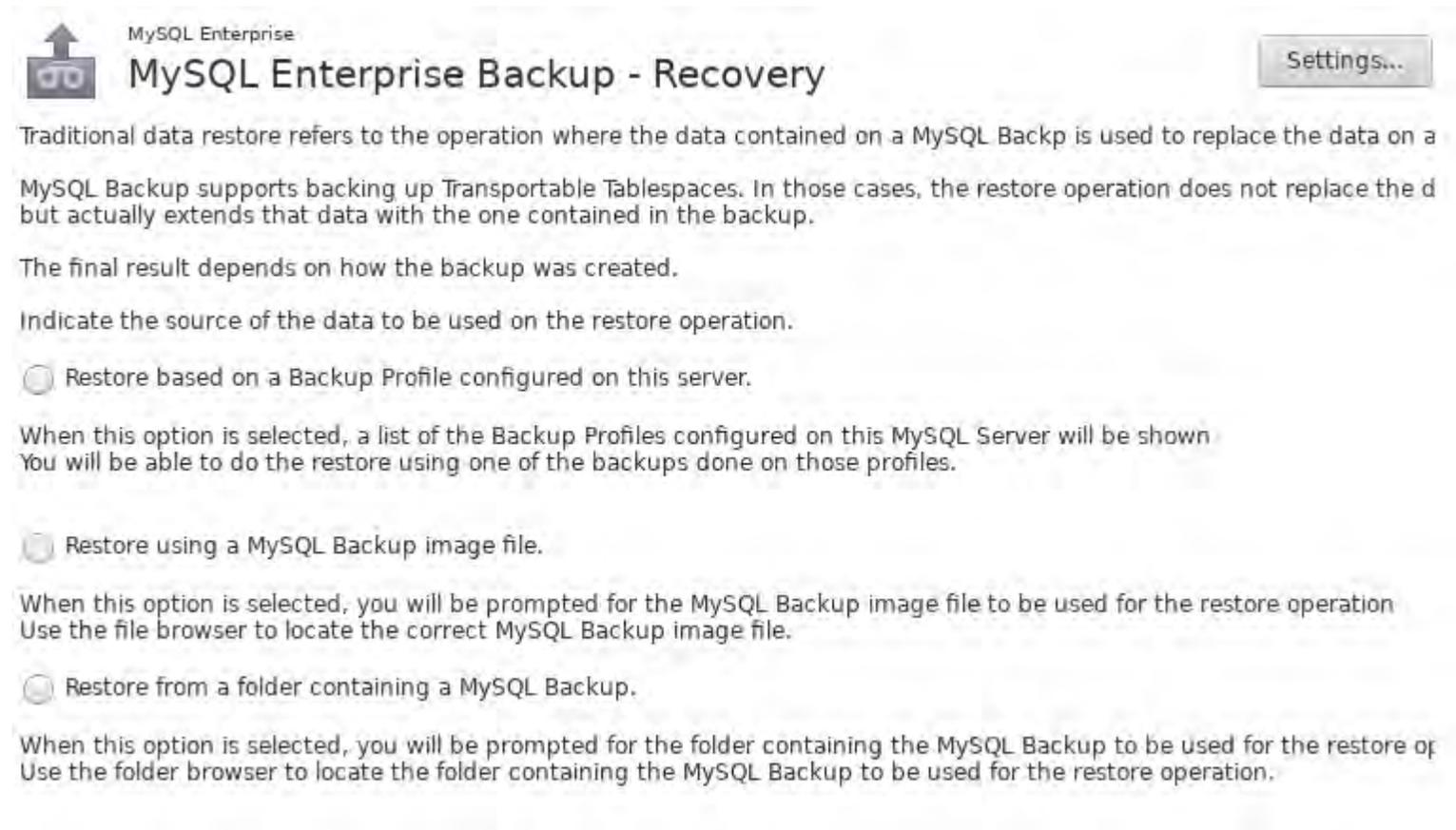
Click on **Restore** in the **MYSQL ENTERPRISE** section of the **MANAGEMENT** pane:



Exercise 10.3

Restore with MySQL Enterprise Backup

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



MySQL Enterprise Backup - Recovery Settings...

Traditional data restore refers to the operation where the data contained on a MySQL Backup is used to replace the data on a MySQL Backup supports backing up Transportable Tablespaces. In those cases, the restore operation does not replace the data but actually extends that data with the one contained in the backup.

The final result depends on how the backup was created.

Indicate the source of the data to be used on the restore operation.

Restore based on a Backup Profile configured on this server.

When this option is selected, a list of the Backup Profiles configured on this MySQL Server will be shown. You will be able to do the restore using one of the backups done on those profiles.

Restore using a MySQL Backup image file.

When this option is selected, you will be prompted for the MySQL Backup image file to be used for the restore operation. Use the file browser to locate the correct MySQL Backup image file.

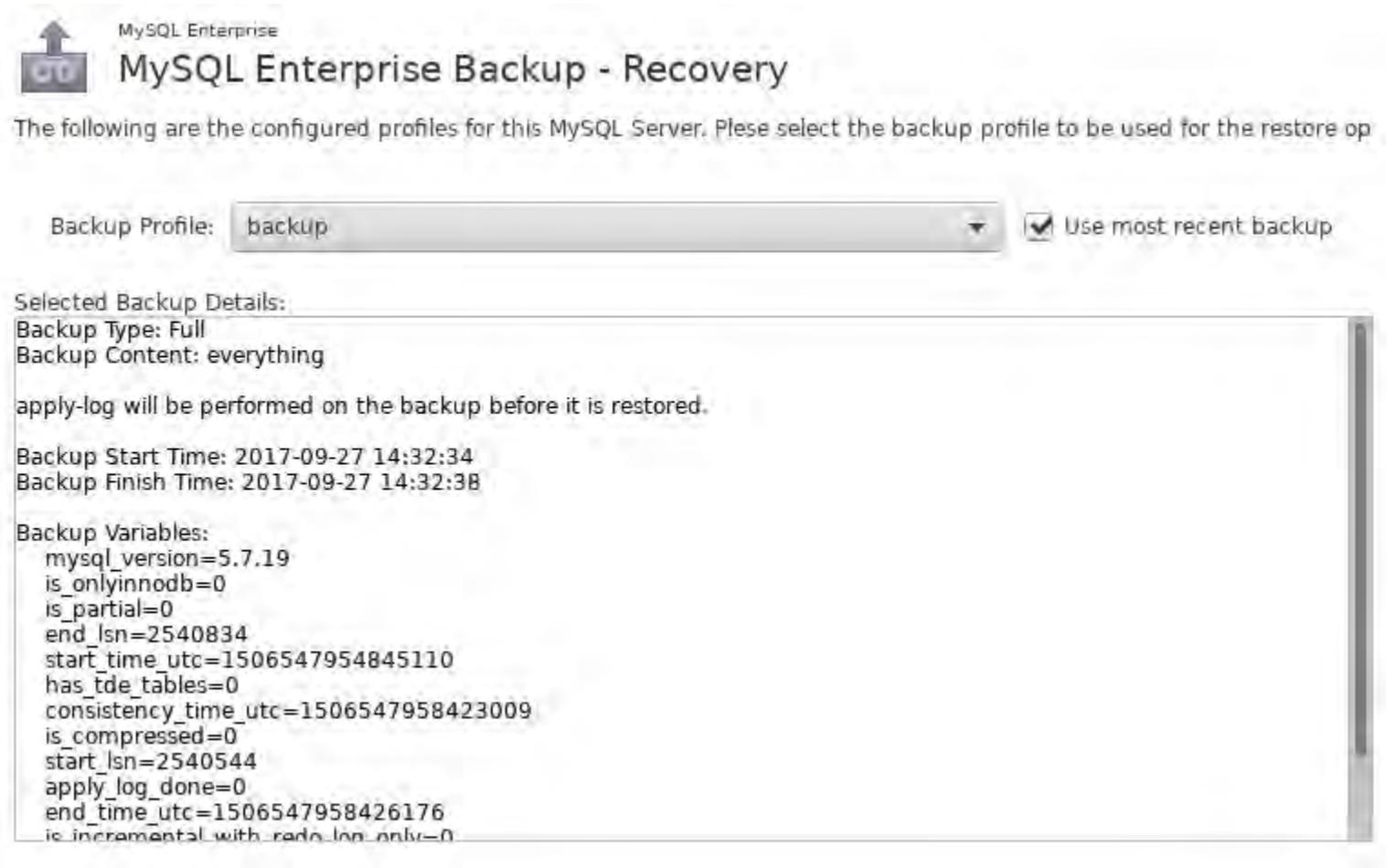
Restore from a folder containing a MySQL Backup.

When this option is selected, you will be prompted for the folder containing the MySQL Backup to be used for the restore operation. Use the folder browser to locate the folder containing the MySQL Backup to be used for the restore operation.

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 >**



The screenshot shows the MySQL Enterprise Backup - Recovery interface. At the top, there is a header with the MySQL Enterprise logo and the title "MySQL Enterprise Backup - Recovery". Below the header, a message states: "The following are the configured profiles for this MySQL Server. Please select the backup profile to be used for the restore operation." A dropdown menu labeled "Backup Profile:" is set to "backup". To the right of the dropdown is a checked checkbox labeled "Use most recent backup". Below this, a section titled "Selected Backup Details:" contains the following information:

```
Backup Type: Full
Backup Content: everything

apply-log will be performed on the backup before it is restored.

Backup Start Time: 2017-09-27 14:32:34
Backup Finish Time: 2017-09-27 14:32:38

Backup Variables:
mysql_version=5.7.19
is_onlyinnodb=0
is_partial=0
end_lsn=2540834
start_time_utc=1506547954845110
has_tde_tables=0
consistency_time_utc=1506547958423009
is_compressed=0
start_lsn=2540544
apply_log_done=0
end_time_utc=1506547958426176
is_incremental_with_redo_log_only=0
```

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

The following tasks will now be executed to revert the state of your server to that of the selected backup.

- Preparing backup for recovery
- Recover backup
- Prepare and apply incremental backup files

Click [Restore >] to start the recovery process.

Show Logs

View Backup Content

< Back

Restore >

Cancel

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

The following tasks will now be executed to revert the state of your server to that of the selected backup.

- Preparing backup for recovery
- Recover backup
- Prepare and apply incremental backup files

Finished performing tasks.

Show Logs

View Backup Content

< Back

Restore >

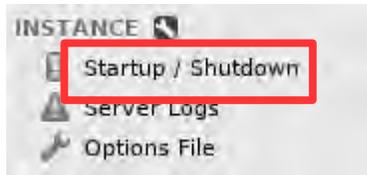
Done

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](#)

A screenshot of the Oracle Enterprise Manager 'Startup / Shutdown MySQL Server' dialog. The dialog title is 'Local Instance 3306 Startup / Shutdown MySQL Server'. The status is 'The database server is stopped. To start the Server, use the "Start Server" button'. The status is also 'The database server instance is stopped'. A red box highlights the 'Start Server' button. Below the dialog is a 'Startup Message Log' showing the following messages:

```
2017-09-27 15:10:25 - Checking server status...
2017-09-27 15:10:25 - Trying to connect to MySQL...
2017-09-27 15:10:25 - Can't connect to local MySQL server through socket '/var/lib/mysql/mysql.sock' (2) (2002)
2017-09-27 15:10:25 - Assuming server is not running
```

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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Fang Restaurant
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from Moscone)

See you there!

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