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# MySQL Enterprise Backup 4.1 Release Notes

## Abstract

This document lists the changes to the MySQL Enterprise Backup 4.1 product, beginning with the most recent release. Each release section covers added or changed functionality, bug fixes, and known issues, if applicable. For information about changes in a different MySQL Enterprise Backup series, see the release notes for that series.

For additional MySQL Enterprise Backup 4.1 documentation, see the [MySQL Enterprise Backup User's Guide \(Version 4.1.5\)](#).

For legal information, see the [Legal Notices](#).

For help with using MySQL, please visit the [MySQL Forums](#), where you can discuss your issues with other MySQL users.

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## Preface and Legal Notices

This document lists the changes to the MySQL Enterprise Backup 4.1 product, beginning with the most recent release.

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## Changes in MySQL Enterprise Backup 4.1.5 (2022-10-11)

- [Functionality Added or Changed](#)
- [Bugs Fixed](#)

### Functionality Added or Changed

- **Important Change:** For `copy-back-and-apply-log` and other [single-file operations](#) except `backup-to-image`, when a relative path is specified for the `--backup-image` option, `mysqlbackup` takes the path as relative to the current working directory in which the `mysqlbackup` command is run. (Bug #29128662)
- The `--rename` option now works with both full and partial restores:
  - If the `--include-tables` and `--exclude-tables` options are not used, all tables in the backup are restored, with the table selected by the `--rename` option renamed as specified.
  - If the `--include-tables` and `--exclude-tables` options are used, all tables selected by the two options together are restored, with the table selected by the `--rename` option renamed as specified.(Bug #31947026)
- When a server using the `keyring_file`, `keyring_encrypted_file`, or `keyring_aws` was backed up, if it did not contain any encrypted InnoDB tables, the keyring file was not included in the backup. That created a problem when, for example, `mysqlbackup` was used for a server upgrade, in which case the keyring file was not preserved in the process. `mysqlbackup` now always looks for the keyring data file and copies it when the above-mentioned keyring plugins are active on the server. (Bug #31820564)
- Encrypted InnoDB tables can now be included in partial backups and restores using [transportable tablespaces \(TTS\)](#). (Bug #31796017, WL #13604)
- The file `backup_gtid_executed.sql` was not included in a TTS backup for a replica server using GTIDs. The file is now included in a TTS backup as long as the `--slave-info` option is used. (Bug #30925447)

- An incremental backup failed if binary logging was disabled on the server during the last backup (on which the incremental backup was based on), but was subsequently enabled before the incremental backup was attempted. It was because `mysqlbackup` did not have the binary log information required to perform the incremental backup. With this fix, `mysqlbackup` skips copying the binary log for an incremental backup when the backup it is based on does not include the binary log.

Also, when restoring onto a server an incremental backup that does not contain the binary log, `mysqlbackup` renames any binary log files that have already been restored onto the server by adding to them the `.old` extension; the same thing happens when an incremental backup is restored with the `--skip-binlog` option. (Bug #30043100)

- A backup now fails when a binary or relay log file is purged while the backup is going on; it also fails when `mysqlbackup` finds a binary log file missing on the server (however, if a relay log file is missing, the backup continues). (Bug #29269039)
- The `--incremental-base` option now accepts a new value, `history:last_full_backup`, which makes it easy to create a [differential backup](#). See the description of `--incremental-base` for details. (WL #14475)

## Bugs Fixed

- On Windows platform, if the `--backup-dir` option was not specified for the `extract` command, `mysqlbackup` quit unexpectedly. With this fix, an error is thrown instead in the situation. (Bug #34522095)
- On Windows platforms, when backing up a server with encrypted InnoDB tables that did not use the `keyring_encrypted_file` plugin, the operation failed when the `--defaults-file` or `--backup-dir` option of the `mysqlbackup` command contained either spaces or a trailing backslash. (Bug #33085629)
- When an encrypted InnoDB table had been flushed and then dropped right before a `backup-and-apply-log` operation, the operation might fail with a `Keyring service not initialized` error. It was because while the encrypted table was not included in the backup, the redo log fragment included in the backup might contain the changes to the table, and the apply log operation failed to apply the changes because the keyring service had never been initialized. With this fix, `mysqlbackup` initializes the keyring service in the situation. (Bug #32461308)
- A backup operation was terminated with signal 6 if the backup involved InnoDB tables encrypted using any keyring plugin other than `keyring_encrypted_file`, but SSL has been disabled for connection to the server. It was because SSL is required for the keyring migration process, which was part of the backup operation. With this fix, before the keyring migration starts, `mysqlbackup` checks that SSL has been enabled on the server and throws a proper error if it has not. (Bug #32434668)
- A restore or validate operation for a compressed backup failed with an `unexpected end of file` error. (Bug #32163271)
- The `--include-tables` and `--exclude-tables` options were ignored during a restore of a TTS backup taken with full locking (i.e., with `--use-tts=with-full-locking`). (Bug #31947026)
- The `--compress` option is ignored in a `backup-and-apply-log` operation for a TTS backup with full locking (`--use-tts=with-full-locking`), resulting in a non-compressed backup. (Bug #31913304)
- When a restore failed for a compressed backup because the `--compress-method` option was used, `mysqlbackup` did not print a meaningful error message. With this fix, the error message indicates that the option is incompatible with the operation. (Bug #31861826)

- A partial backup operation in which an excluded table was stored in an external tablespace failed with the complaint that the `.ibd` file was too big. It was because of the mishandling of the `.isl` files involved, which has been corrected by this patch. (Bug #31724848)
- A restore of a compressed backup failed if the backed-up server did not use `.ibd` as the extension for InnoDB tablespaces. (Bug #31596356)
- During a backup operation, if `mysqlbackup` failed with its query for the server status variable `InnoDB_buffer_pool_dump_status`, it ignored the error and then hung. (Bug #31445204)
- A restore for an incremental backup failed if the full backup it was based on was created with the `--skip-relaylog` option, but the incremental backup was created without using the option. (Bug #31124611)
- When backing up to a tape through a media management software (MMS), `mysqlbackup` always set a default value of `0000-00-00 00:00:00` for the `file_creation_time` and `file_expiry_time` values for the operation's entry in the `backup_sbt_history` table on the backed-up server. If the backup failed for some reasons, those zero values were then written to the table. If, later, the `backup_sbt_history` table was queried in `NO_ZERO_DATE` or `NO_ZERO_IN_DATE` SQL mode, the server returned `ERROR 1194 (HY000): Table 'backup_sbt_history' is marked as crashed and should be repaired`. With this fix, in the case of a backup failure, `mysqlbackup` writes the current time during the backup to those values, so the time values will never be zeros. (Bug #30275637)
- In a `backup-and-apply-log` operation, the connection to the server was kept open even after the backup phase of the operation was over. With this fix, the connection is closed when the operation enters the apply-log phase, in order to free up resources. (Bug #30012743)
- When attempt was made to restore a backup created by a higher version of `mysqlbackup`, the operation failed with `mysqlbackup` giving a cryptic message. With this fix, the error message explains clearly that the issue is with version incompatibility. (Bug #29873900)
- When a backup created with the `--incremental-with-redo-log-only` option was restored, the binary log was missing on the restored server, so the server could not be started. (Bug #29861999)
- A backup failed when it involved encrypted InnoDB tables and the `--skip-unused-pages` option was used. (Bug #29861298)
- When a compressed backup was created with the `backup-and-apply-log` command and then restored using the `copy-back-and-apply-log` command, the redo log were missing from the restored server, causing an InnoDB error when the server was started. (Bug #29851603)
- When the `--skip-binlog` option was used with a restore operation of a TTS backup, the operation failed. With this fix, the option is ignored in the situation. (Bug #29813666)
- When the `--compress-method` option was set to `none`, the backup was finished without compression as expected, but `mysqlbackup` printed erroneous compression information and saved the InnoDB tablespace files with the `.ibz` extension. With this fix, the described behaviours of `mysqlbackup` no longer occur in the situation. (Bug #29806518)
- The `--compress-level` option took up a value of `0` instead of the default value of `1` when the `--compress-method` option was used without the `--compress` option. With this fix, the default value of the option is always honored (for the applicable compression methods). (Bug #29806518)
- When the server to be backed up has `super_read_only=ON`, `mysqlbackup` gave the warning that the backup operation could not be logged even if the `--no-history-logging` option has already been used with the backup command. This patch removes the unnecessary warning. (Bug #29742011)

- A `backup-and-apply-log` operation failed for a TTS backup if the `--compress` option was used. (Bug #29639871)
- During a partial backup, `mysqlbackup` mishandled some tables stored under the data directory as if they were stored in external tablespaces, when both types of tablespaces existed on the server. (Bug #29590235)
- Restore of an incremental backup failed when the backed-up server contained a partitioned table with partitions stored in different directories and the table was renamed before the incremental backup was taken, if any of the partitions was not altered after the table's name change. It was because `mysqlbackup` did not recreate all the `.isl` files for all table partitions after the restore, and this fix corrects the issue. (Bug #29297920)
- Backups for a server containing encrypted InnoDB tables failed when the server was of 64-bit and `mysqlbackup` was of 32-bit (or vice versa). It was due to the way keyring files were handled in the situation, which has been fixed by this patch. (Bug #29292085)
- A backup created on an EL7 platform containing InnoDB tables encrypted with MySQL Enterprise Transparent Data Encryption (TDE) could not be restored to a server on a Solaris platform. It was because in this case, the source and the target platforms of the backup used different byte ordering formats, causing difficulties in loading the encryption key from the backup. This fix prevents the issue by adding detection and conversion utilities for different system architectures. (Bug #28569367)
- A `backup-and-apply-log` operation running with the `--compress` option printed wrong information on the compression and at the wrong time. With this patch, correct information is printed after the compression is finished. (Bug #28428760)
- A restore operation failed for a backup image created with the `backup-dir-to-image` command from a directory backup, if the backed-up server used a keyring plugin other than `keyring_encrypted_file` for InnoDB table encryption. It was because the `backup-dir-to-image` operation mishandled the `keyring_kef` file in the backup, and this patch corrects the problem. (Bug #27874581)
- While changing the system variable `innodb_data_file_path` on the server in between a full and an incremental backup makes the incremental backup not restorable, `mysqlbackup` finished the incremental backup successfully under the situation. With this fix, an error is thrown in this case, to avoid the creation of an unrestoreable incremental backup. (Bug #27580477)
- During an incremental backup, even tables that were unchanged were said to be copied in the output messages by `mysqlbackup`. With this fix, the messages say the tables are being checked instead. (Bug #27576904)
- After a backup operation, the entry for `innodb_buffer_pool_filename` appeared twice in the `backup-my.cnf` file. (Bug #27217884)
- An `apply-log` operation on a compressed directory backup created extra `.ibd` files in the backup directory. (Bug #26920318)

## Changes in MySQL Enterprise Backup 4.1.4 (2020-01-24)

- [Functionality Added or Changed](#)
- [Bugs Fixed](#)

### Functionality Added or Changed

- When `mysqlbackup` fails to connect to a server, the warning returned by `mysqlbackup` now includes the hostname and port number for TCP connections, and the socket information for socket connections.

This is particularly helpful for a Group Replication setup, for which `mysqlbackup` might attempt to connect to more than one host. (Bug #30040027)

- Before the current release, when backing up a server that used the `keyring_okv` plugin for InnoDB table encryption, `mysqlbackup` must not be run by a sudo user of its operating system. This restriction has now been removed. (Bug #29020232)
- A new option, `--lock-wait-retry-count`, can now be used to specify the maximum number of retries to be attempted by `mysqlbackup` after the `FLUSH TABLES WITH READ LOCK` statement, issued during the final stage of a backup to temporarily put the database into a read-only state, fails due to a timeout. See the description of the option for details. (Bug #26008480)
- The `--uncompress` option is now supported for the `extract` operation: Files from a compressed single-file backup can now be extracted and uncompressed with a single command. (WL #13233)

## Bugs Fixed

- A backup failed for a server containing encrypted InnoDB tables when `mysqlbackup` was connected to it with `--socket` option. It was because `mysqlbackup` did not pass the value of `--keyring-migration-socket` to the keyring migration server; this fix makes `mysqlbackup` pass the option whenever it connects to the server to be backed up with a Unix socket or Windows named pipe. (Bug #30082039)
- A compressed and encrypted single-file backup was sometimes corrupted if the backed-up server was configured with `innodb_file_per_table=OFF`. (Bug #29798621)
- Backups on busy servers failed due to redo log overwrites, even when the redo log size was big. It was actually caused by a costly but unnecessary check for relay log overwrites, which has been removed by this fix. (Bug #29526337)
- When tables were altered in some ways during backup (for example, renamed, deleted and then replaced by tables of the same names, and so on), `mysqlbackup` reported success for the backup, but the backup could not be restored. This fix makes sure all those cases of table alterations are properly handled by `mysqlbackup`, so the backup can be restored. (Bug #29462340)
- A back up failed with `mysqlbackup` complaining that `Error Log scan was only able to reach...` if the server to be backed up was started with the system variable setting `innodb_checksum_algorithm=none`. (Bug #29285006)
- A restore operation failed with the error that the binary log index file could not be opened if the binary log base name for the backed-up server was a substring of the word "index". (Bug #29273947)
- When backing up a server that used the `keyring_okv` plugin for InnoDB table encryption, if the `--host`, `--user`, and `--port` options were not specified with the `mysqlbackup` command via the command line or a configuration file, the backup failed. It was because in that case, `mysqlbackup` had no values for those options it could use to connect to the server that took care of keyring operations. With this fix, default values are now set, so that `mysqlbackup` connects to the server on `localhost` as `root` and on port `3306` for keyring operations when those options are not specified. (Bug #29015923)
- A restore operation for a TTS backup failed if the backed-up server has `ANSI_QUOTES` as one of its SQL modes, as specified in its system variable `sql-mode`. (Bug #28979134)
- Attempts to extract binary log files from a compressed backup failed with a `No such file or directory` error when the size of the binary log files on the backed up server was greater than 16MB. (Bug #28787312)

- After restoring an incremental backup taken from a MySQL Community Server with encrypted InnoDB tables, the keyring file of the restored server became corrupted, so the server could not be started. (Bug #28422191)
- During the InnoDB buffer pool dump in a backup operation, `mysqlbackup` sometimes reported failure for the dump while it was actually still in progress. The fix prevents the problem by improving the way `mysqlbackup` checks for the status of the dump. (Bug #27185901)
- `mysqlbackup` tried to connect to a remote host specified by the `--host` option, while it was supposed to ignore the option (see [Connection Options](#) for details). With this fix, the option is now ignored.

**Note**

As a side-effect of this change, on Unix-like platforms, `mysqlbackup` command that used the `--host` option now needs to use the `--protocol=TCP` option to indicate explicitly that `mysqlbackup` is to connect to `localhost` using TCP/IP.

(Bug #25911987)

- Backups failed for database containing tables created with [transparent page compression](#), with complaints of page corruption. It was because `mysqlbackup` did not perform decompression before data validation, and that has been corrected with this fix. (Bug #24366571)
- A backup failed at the step when `mysqlbackup` applied the `FLUSH TABLES tbl_name [, tbl_name] ... WITH READ LOCK` statement on all non-InnoDB tables if any table names contained reserved words or special characters. It was because `mysqlbackup` did not enclose table names in backticks when issuing the statement, and this fix makes sure that is done. (Bug #19709505, Bug #74144)

## Changes in MySQL Enterprise Backup 4.1.3 (2019-02-15)

- [Functionality Added or Changed](#)
- [Bugs Fixed](#)

### Functionality Added or Changed

- In addition to the requirement that the target data directory for a restore specified by the `--datadir` option must be non-existent or empty, `mysqlbackup` now enforces the same rule for the `--innodb_data_home_dir`, `--innodb_log_group_home_dir`, and `--innodb_undo_directory` options (the `--force` option cannot be used to override the requirement on the three options). (WL #12665, WL #12407)

### Bugs Fixed

- MySQL Enterprise Backup 4.1 failed to backup a MySQL Server that has been backed up by MySQL Enterprise Backup 4.0 before. It was due to the way the `backup_history` table was queried, which has now been fixed. (Bug #29208386)
- When working with a Group Replication cluster, `mysqlbackup` might quit unexpectedly near the end of a backup operation when, in order to write to the `backup_history` table, it tried to connect with an unencrypted connection to one of the nodes on which the backup user had not logged on before. It happened when the backup user was created with the [caching\\_sha2\\_password plugin](#) plugin, so that it must log on with an encrypted connection when it connected to the server for the first time; the attempt to log on thus failed, and `mysqlbackup` could not handle the failure. With this fix, at such failures,

`mysqlbackup` quits gracefully with the warning that the backup operation is finished without updates to the backup history. (Bug #28893180)

- Restoring an incremental backup image using the `copy-back-and-apply-log` command failed with `mysqlbackup` complaining that the server repository configuration (including, for example, value of `innodb_data_file_path`) was unknown for the target server, unless the configuration is explicitly supplied to `mysqlbackup`. With this fix, `mysqlbackup` gets the required information from the `backup-my.cnf` file already restored with the base backup of the incremental backup. (Bug #28411028)
- A restore operation could corrupt a backup when, by mistake, a user specified the source directory to become the target directory for restoring some files (for example, specifying what was the backup's `--backup_innodb_data_home_dir` value as the restore's `--innodb_data_home_dir` value). This fix prevents the problem by having `mysqlbackup` throw an error when the command options make the source and target file paths the same for any file copying during a restore. (Bug #28376873)
- On FreeBSD platforms, using the `--show-progress` option did not make `mysqlbackup` print progress reports. (Bug #28350122)
- After encrypted InnoDB tables have been restored, sometimes the restored server could not be started, or the encrypted InnoDB tables could not be opened after the server had been started.

This fix not only resolves the aforementioned issues, but also two other problems: the failure to restore a backup containing encrypted InnoDB tables that were row-compressed, and the failure to complete a backup when an encrypted InnoDB table was created in the middle of the backup operation. (Bug #28301281)

References: See also: Bug #28360241, Bug #27168458.

- While MySQL Server interprets the system variable setting `--innodb_checksum_algorithm=0` to mean `--innodb_checksum_algorithm=crc32`, a `mysqlbackup` operation (except for backup) failed when `--innodb_checksum_algorithm=0` was set as a configuration option on the backed up server. With this fix, `mysqlbackup` now takes `--innodb_checksum_algorithm=0` as valid and interprets it as `--innodb_checksum_algorithm=crc32`. (Bug #28295519)
- The Windows version of MySQL Enterprise Backup did not display its build ID when invoked. (Bug #27916702)
- `mysqlbackup` quit unexpectedly when backing up a MySQL Server of release 4.1.2 or later for the first time if the `ALTER` privilege on the `mysql.backup_history_new` table had not been granted to the MySQL user with which `mysqlbackup` connected to the server. With this fix, `mysqlbackup` quits gracefully in the situation after throwing the proper error.

Also, the `CREATE`, `INSERT`, and `DROP` privileges on `mysql.backup_history_old` and `CREATE`, `INSERT`, `DROP`, and `ALTER` privileges on `mysql.backup_history_new` are now required only for backing up for the first time a MySQL Server that has been upgraded from 5.7.22 or earlier and has been backed up by MySQL Enterprise Backup before. (Bug #27879530, Bug #28546256)

- When the `--show-progress=table` option was used, `mysqlbackup` gave a warning in the error log on an aborted connection to the server near the end of the operation. It was because the connection to the server for writing to the `backup_progress` table had remained open. With this fix, the connection is properly closed after the `mysqlbackup` operation is finished. (Bug #27647283)
- A restore operation for an incremental backup failed when individual tablespaces with relative file paths were involved. (Bug #26442994)
- When the option `--only-innodb-with-frm` or `--no-locking` was used during a backup operation, the backup sometimes failed with `mysqlbackup` complaining that the highest LSN was larger in a

copied page than on the backed-up server. It was because `mysqlbackup` did not perform a log flushing before copying the redo log when either of the mentioned options was used. With this fix, log flushing was always performed to prevent the error. (Bug #25412655)

- Partial backups sometimes failed because full-text index files had their file names matched by the regular expression provided by the `--include-tables` option, and the files were then handled as ordinary tablespace files by `mysqlbackup`. With this fix, `mysqlbackup` excludes any full-text index files from backups. (Bug #25044900)
- If, when a backup was in progress and `mysqlbackup` was reading the binary log (or the relay log) index file and the server tried to modify the index file (because, for example, a log flush or log purge just took place), the binary logging (or relay logging) stopped; the server also quit unexpectedly on Windows platforms. It was because `mysqlbackup` did not handle well the file sharing violation. With this fix, `mysqlbackup` now reads the index file using the local file system API, which handles the file sharing violation gracefully; also, `mysqlbackup` now copies the index file into its buffer and then closes it, instead of keeping it open for long, so the server can modify or delete the index file more easily. (Bug #22914974, Bug #26047119)

## Changes in MySQL Enterprise Backup 4.1.2 (2018-07-27)

- [Functionality Added or Changed](#)
- [Bugs Fixed](#)

### Functionality Added or Changed

- **Important Change:** Starting from release 4.1.2, the storage engine of the `mysql.backup_history` table on a backed-up server has switched from CSV to InnoDB, and a new column for server UUIDs has been added to the table. See [Backup History Table Update](#) for the new user privileges required by `mysqlbackup` due to this change. (WL #12042)
- **Important Change:** When working with a [Group Replication](#) setup, `mysqlbackup` now makes the backup history available to all members of the server group by making sure that the `backup_history` table is updated on a primary node after each `mysqlbackup` operation. See [Using MySQL Enterprise Backup with Group Replication](#) for details.

With the implementation of this feature, the new user privilege of `SELECT` on `performance_schema.replication_group_members` is now required by `mysqlbackup` to work with any server, even when it does not belong to a Group Replication setup. See [Grant MySQL Privileges to Backup Administrator](#) for details. (WL #12042)

- The relay log for a backed-up slave server, instead of being restored always to the data directory on the target slave server, is now restored by default to the same location it was found on the backed-up slave server. It can also be restored to a different location specified with the new `--relay-log` option. (Bug #25141738, Bug #83927, WL #12040)
- The binary log for a backed-up server, instead of being restored always to the data directory on the target server, is now restored by default to the same location it was found on the backed-up server. It can also be restored to a different location specified with the new `--log-bin` option. (Bug #25141738, Bug #83927, WL #12040)
- The `backup_history` table now includes a `server_uuid` column, which stores the value of the `server_uuid` of the backed up server. (WL #12043)
- OAuth is now supported for Oracle Cloud Storage client authentication. Two new options, `--cloud-storage-url` and `--cloud-oauth-token`, have been introduced for the purpose. See [Cloud Storage Options](#) for details. (WL #12041)

## Bugs Fixed

- During an `--apply-incremental-backup` operation, `mysqlbackup` attempted to delete the binary log of the backed-up, running server. (Bug #28377502)
- A `mysqlbackup` operation on an image stored on an OpenStack cloud storage service sometimes failed with a segmentation fault or a bad URL error. It was because of a race condition caused by an uninitiated variable, which has been eliminated by this fix. (Bug #28189239, Bug #28183729)
- Backups failed when the `--log-bin` option on the backed-up server contained a full-path pointing to a location under the server's data directory. (Bug #28044530)
- A `mysqlbackup` operation on an image stored on an OpenStack cloud storage service failed with a `401 Unauthorized` error when the operation took a long time and the authentication token for the cloud access expired. With this fix, a separate thread in `mysqlbackup` requests a new token from the OpenStack cloud service in that situation, so that the operation can continue. (Bug #27893174)
- The maximum value that could be set for the `--safe-slave-backup-timeout` option was 2700 (seconds), which automatically replaced any larger value. With this fix, there is no longer a maximum limit, even though a high value is not recommended; see the description of `--safe-slave-backup-timeout` for details. (Bug #27883020)
- When `mysqlbackup` performed sanity checks on InnoDB tablespaces and found a space ID mismatch for an FSP header and a page header, the name of the problematic tablespace was not given in the error report. (Bug #27752703)
- `mysqlbackup` issued a warning whenever the number of files specified in the system variable `innodb_data_file_path` of the server to be backed up exceeded 100. With this fix, a warning is issued only if the number of InnoDB data files to be opened exceeds the number specified by the system variable `innodb_open_files`. (Bug #27701402)
- An `apply-incremental-backup` operation failed when individual tablespaces with relative file paths were involved. (Bug #27278876)
- Backups created with the `---skip-unused-pages` option failed validation by the `mysqlbackup validate` command. (Bug #27102697)
- `mysqlbackup` quit unexpectedly when the `--disable-manifest` option was used in a backup operation. (Bug #26861475)
- A restore operation for an incremental backup failed when individual tablespaces with relative file paths were involved. (Bug #26442994)

## Changes in MySQL Enterprise Backup 4.1.1 (2018-04-27)

- [Functionality Added or Changed](#)
- [Bugs Fixed](#)

### Functionality Added or Changed

- *For MySQL Server 5.7.21 and later:* Servers' use of the `keyring_encrypted_file` and `keyring_aws` plugins is now supported. See [Working with Encrypted InnoDB Tables](#) for details. (Bug #27127898, WL #10217)
- Information on the executed GTIDs is now included in the `mysqlbackup` output and the backup log when the backed-up server has GTIDs enabled. (Bug #25978803)

- The buffer size for cloud transfers can now be specified using the new `--cloud-buffer-size` option. See [Cloud Storage Options](#) for details. (WL #11113)
- HTTP Basic Authentication and non-chunked transfer are now supported for backup and restore using OpenStack Swift-compatible object storage services. Two new options, `--cloud-basicauth-url` and `--cloud-chunked-transfer`, have been introduced for these purposes. See [Cloud Storage Options](#) for details. (WL #11112, WL #11113)

## Bugs Fixed

- `mysqlbackup` failed to restore a TTS (transportable tablespace) backup if the row format of any TTS tables did not match the InnoDB default row format on the target server. This was because the row format of a table was not included in the backup if the table was created with the InnoDB default row format. With this fix, the row format is now always written to the backup, so that tables are always restored with the right row format. (Bug #27445546)
- `mysqlbackup` failed to backup to an Amazon S3 cloud storage. (Bug #27231229)
- `mysqlbackup` could not establish a connection to the server with a Unix socket using the option `--protocol=SOCKET`. (Bug #26977679)
- `mysqlbackup` did not indicate in its output whether an established connection with the server was encrypted or not. With this fix, the crucial information is now provided. (Bug #26919023)
- An `apply-log` operation failed when more than one process threads were used for the operation and the backup contained encrypted InnoDB tables. (Bug #26495013)
- On macOS, `mysqlbackup` failed to determine the relay log file name correctly if the relay log index file name was not specified. (Bug #25574605)
- `mysqlbackup` only accepts values for `--ssl-mode` in upper case. With this fix, the option's value has become case insensitive. (Bug #25548088)
- After restoring an incremental backup of a slave server, the file `ibbackup_slave_info` was missing from the `meta` folder under the backup directory on the target server. (Bug #25097753)
- When a compressed backup was restored with the `--innodb_data_home_dir` option pointing to a restore location outside of the data directory, `.ibd` files were still being copied into the data directory, causing an exception to be thrown at the attempt to start the restored server. (Bug #24826986)

## Changes in MySQL Enterprise Backup 4.1.0 (2017-03-03)

- [Security Notes](#)
- [Functionality Added or Changed](#)
- [Bugs Fixed](#)

## Security Notes

- The linked OpenSSL library for MySQL Enterprise Backup 4.1 has been updated to version 1.0.2k. (Bug #25615449)

## Functionality Added or Changed

- A backup became corrupted if, during the backup process, a DDL operation that took advantage of MySQL server's [online DDL feature](#) occurred. This was because `mysqlbackup` did not support the

server feature—and it still does not. This fix avoids the error by having `mysqlbackup` turn the server's system variable `old_alter_table` to “1” at the beginning of a backup if it is “0,” so that any DDL operations that take place during the backup are handled with the old table copy method. `mysqlbackup` then turns the variable back to “0” near the end of the backup operation.



### Important

Notice that in cases where `mysqlbackup` quits unexpectedly and does not turn `old_alter_table` back to its original value, the user will have to turn the value back to “0” manually on the server, in order to return the server to its original configuration. This should be performed if the statement “Server system variable 'old\_alter\_table' was set to '0'. Setting it to '1'” appears in the early output of `mysqlbackup`, but the statement “Setting server system variable 'old\_alter\_table' back to '0'” does not appear before `mysqlbackup` quits.

(Bug #25217215)

- MySQL Enterprise Backup now supports the `--ssl-mode` option, which enables you to specify the security state of the connection to the server. It replaces the client side `--ssl` and `--ssl-verify-server-cert` options, which are now deprecated. See the description of the `--ssl-mode` option in [MySQL 5.7 Reference Manual](#) for details. (Bug #23508228)
- A new option, `--skip-final-rescan`, makes `mysqlbackup` skip the final rescan for InnoDB tables that are modified by DDL operations after the database has been locked near the end of a backup operation. This potentially shortens the duration for the lock and reduces the backup's impact on the server's normal operation. See the description for `--skip-final-rescan` for details. (Bug #21094221)
- The output by `mysqlbackup`, which goes to the `stderr` stream and the message log, has now been improved to include the timestamps and thread IDs for all steps taken by `mysqlbackup`, in order to provide more information for debugging purposes. (Bug #20142619)
- During the final stage of a backup when MySQL Enterprise Backup tried to temporarily put the database into a read-only state using the `FLUSH TABLES WITH READ LOCK` statement in order to copy non-InnoDB files, if a long query was running on the server at the same time, the `FLUSH TABLES WITH READ LOCK` statement could be taking too long to finish, holding up further queries and eventually bringing down the server.

A new `mysqlbackup` option `--lock-wait-timeout` can now be used to specify the timeout in seconds for the `FLUSH TABLES WITH READ LOCK` statement. If the timeout is exceeded, the statement is failed and the lock on the tables is released, so that queries held up by the lock can then be executed. `mysqlbackup` then retries the statement and continues with the backup. Default value for `--lock-wait-timeout` is 60 [seconds]. (Bug #14339483)

- The `backup_history` table now includes the following new columns:
  - `start_time_utc`
  - `end_time_utc`
  - `consistency_time_utc`
  - `meb_version`

(WL #8416)

- A full set of exit codes have now been implemented for MySQL Enterprise Backup. Also, a new `mysqlbackup` command, `print-message`, returns an exit message for any given exit code supplied

with the new option `--error-code`. See [Exit codes of MySQL Enterprise Backup](#) for details. (WL #8291)

- To increase the performance for hot backups, `mysqlbackup` now shortens the final phase of the backups by resizing the MyISAM key cache before it locks the database with a `FLUSH TABLES WITH READ LOCK` statement. The resize triggers a flush of the MyISAM key cache, which reduces the time it takes to run the `FLUSH TABLES WITH READ LOCK` statement. The MyISAM key cache size is changed back to its original value afterward. (WL #9311)
- Apply-log operations can now be performed with multiple worker threads in parallel, which can improve performance for the operations. The number of threads to be used can be specified with the `--process-threads` option. (WL #9368)
- The copying of redo log files into backups has been made faster, shortening the overall backup time in some cases and making it less likely that a backup fails because a redo log file has been overwritten before it is copied. (WL #9350)
- MySQL Enterprise Backup now supports *optimistic incremental backup*, in which `mysqlbackup` scans only those InnoDB data files that have been modified since the last backup for changed pages and then saves them into the incremental backup. It potentially makes incremental backups faster, and is performed by specifying `--incremental=optimistic`. See [Full-scan versus Optimistic Incremental Backup](#) for details. (WL #8416)
- In order to minimize the impact of a hot backup on the MySQL server, the copying of the buffer pool dump files and some of the metadata files is now performed before the final phase of the backup in which the server instance is locked. This shortens the duration for the lock and reduces the backup's impact on the server's normal operation.

Also, to minimize the resource used on a backup, the copying of the buffer pool dump files is no longer performed for partial and offline backups, for which the buffer pool dump is usually not very useful. (WL #9309, WL #9313)

## Bugs Fixed

- The [Release](#) number for the RPM packages of MySQL Enterprise Backup always said "1," instead of giving the release number of the Linux distribution for which the package was built. (Bug #25538798)
- An `apply-log` or `apply-incremental-backup` operation failed when, during the time the backup was created, any tables have been dropped and then recreated with the same name for more than once. (Bug #25334929)
- When creating a full image backup with the `--no-locking` option, `mysqlbackup` failed to write the binary log information to the backup history table and the `backup_variables.txt` file. The result was that when creating an incremental image backup based on the full backup, the attempt to copy the binary log files from the server into the incremental image backup (which is the default behavior) would fail, causing the incremental backup to stop. With this fix, the binary log information is no longer missing after the full backup, so the incremental image backup no longer fails." (Bug #25296324)

References: See also: Bug #19915713.

- A backup operation sometimes failed due to corruption of the copied redo log, and the corruption occurred because checksum validation for redo logs was not activated for `mysqlbackup`. This fix restores the checksum function, so that the validation is performed when `innodb_log_checksums=ON` on the backed up server. When a chunk of redo log data fails the validation, `mysqlbackup` tries to re-read the data from the server.

However, redo log checksum validation is not performed for offline backups, and online backups fail when the value of `innodb_log_checksums` is switched off on the server when the backup is in progress. (Bug #25057394)

- `mysqlbackup` logged double entries with wrong information into the `backup_history` table for optimistic backups. (Bug #24502876)
- Backups for a slave server in a multi-source replication setup using the `--slave-info` option failed. (Bug #24444950)

References: See also: Bug #21830316.

- If a backed up server was configured with `innodb_undo_tablespaces` being nonzero, during a backup, `mysqlbackup` emitted meaningless warning messages about the tablespaces already existing in the cache. This fix removes those messages. (Bug #24400230)
- During an `apply-log` or a `copy-back-and-apply-log` operation on a backup with encrypted InnoDB tables, if no value was specified for the `--encrypt-password` option used, the operation failed with the complaint that no encryption password was specified. With this fix, `mysqlbackup` asks the user for the encryption password when it is in the same situation. (Bug #24364442)
- An `apply-log` operation failed for a backup of a server that contained tablespaces outside of its data directory. It was because those tablespaces, unlike tablespaces in the data directory, were not loaded by `mysqlbackup` before the `apply-log` operation started. This fix ensures all tablespaces are loaded. (Bug #22026145)
- When running the `backup-and-apply-log` command without a connection to the MySQL server, `mysqlbackup` could not know the correct binary log file name and binary log position for the backup; yet, at the end of the `backup-and-apply-log` operation, `mysqlbackup` still printed out some values for the binary log file name and position, which were random in nature. (Bug #21623089)

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