MySQL Information Schema
Abstract

This is the MySQL Information Schema extract from the MySQL 8.0 Reference Manual.

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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# Table of Contents

Preface and Legal Notices ........................................................................................................................................... v

1 INFORMATION_SCHEMA Tables ................................................................................................................................. 1
2 The INFORMATION_SCHEMA ADMINISTRABLE_ROLE_AUTHORIZATIONS Table ........................................ 3
3 The INFORMATION_SCHEMA APPLICABLE_ROLES Table ................................................................................. 5
4 The INFORMATION_SCHEMA CHARACTER_SETS Table .................................................................................... 7
5 The INFORMATION_SCHEMA CHECK_CONSTRAINTS Table .............................................................................. 9
6 The INFORMATION_SCHEMA COLLATIONS Table ............................................................................................... 11
7 The INFORMATION_SCHEMA COLLATION_CHARACTER_SET_APPLICABILITY Table ..................... 13
8 The INFORMATION_SCHEMA COLUMNS Table ................................................................................................. 15
9 The INFORMATION_SCHEMA COLUMN_PRIVILEGES Table ............................................................................ 19
10 The INFORMATION_SCHEMA COLUMN_STATISTICS Table ....................................................................... 21
11 The INFORMATION_SCHEMA ENABLED_ROLES Table ..................................................................................... 23
12 The INFORMATION_SCHEMA ENGINES Table ................................................................................................. 25
13 The INFORMATION_SCHEMA EVENTS Table .................................................................................................. 27
14 The INFORMATION_SCHEMA FILES Table ....................................................................................................... 31
15 The INFORMATION_SCHEMA KEY_COLUMN_USAGE Table ........................................................................ 39
16 The INFORMATION_SCHEMA KEYWORDS Table ............................................................................................. 41
17 The INFORMATION_SCHEMA OPTIMIZER_TRACE Table .................................................................................. 43
18 The INFORMATION_SCHEMA PARAMETERS Table ............................................................................................ 45
19 The INFORMATION_SCHEMA PARTITIONS Table ............................................................................................ 47
20 The INFORMATION_SCHEMA PLUGINS Table ................................................................................................ 51
21 The INFORMATION_SCHEMA PROCESSLIST Table ......................................................................................... 53
22 The INFORMATION_SCHEMA PROFILING Table ............................................................................................. 55
23 The INFORMATION_SCHEMA REFERENTIAL_CONSTRAINTS Table ............................................................ 57
24 The INFORMATION_SCHEMA RESOURCE_GROUPS Table ............................................................................. 59
25 The INFORMATION_SCHEMA ROLE_COLUMN_GRANTS Table .................................................................. 61
26 The INFORMATION_SCHEMA ROLE_ROUTINE_GRANTS Table ..................................................................... 63
27 The INFORMATION_SCHEMA ROLE_TABLE_GRANTS Table ............................................................................ 65
28 The INFORMATION_SCHEMA ROUTINES Table ............................................................................................... 67
29 The INFORMATION_SCHEMA SCHEMATA Table ............................................................................................... 71
30 The INFORMATION_SCHEMA SCHEMATA_EXTENSIONS Table .................................................................... 73
31 The INFORMATION_SCHEMA SCHEMA_PRIVILEGES Table ............................................................................ 75
32 The INFORMATION_SCHEMA STATISTICS Table ............................................................................................ 77
33 The INFORMATION_SCHEMA ST_GEOMETRY_COLUMNS Table ...................................................................... 81
34 The INFORMATION_SCHEMA ST_SPATIAL_REFERENCE_SYSTEMS Table ...................................................... 83
35 The INFORMATION_SCHEMA ST_UNITS_OF_MEASURE Table ........................................................................ 85
36 The INFORMATION_SCHEMA TABLES Table ..................................................................................................... 87
37 The INFORMATION_SCHEMA TABLESPACES Table .......................................................................................... 91
38 The INFORMATION_SCHEMA TABLE_CONSTRAINTS Table .......................................................................... 93
39 The INFORMATION_SCHEMA TABLE_PRIVILEGES Table ................................................................................ 95
40 The INFORMATION_SCHEMA TRIGGERS Table ................................................................................................. 97
41 The INFORMATION_SCHEMA USER_ATTRIBUTES Table .................................................................................. 99
42 The INFORMATION_SCHEMA USER_PRIVILEGES Table ................................................................................ 101
43 The INFORMATION_SCHEMA VIEWS Table .................................................................................................... 103
44 The INFORMATION_SCHEMA VIEW_ROUTINE_USAGE Table ....................................................................... 105
45 The INFORMATION_SCHEMA VIEW_TABLE_USAGE Table ............................................................................... 107
46 Extensions to SHOW Statements ....................................................................................................................... 109
47 MySQL 8.0 FAQ: INFORMATION_SCHEMA ........................................................................................................ 111
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Chapter 1 INFORMATION_SCHEMA Tables

INFORMATION_SCHEMA provides access to database metadata, information about the MySQL server such as the name of a database or table, the data type of a column, or access privileges. Other terms that are sometimes used for this information are data dictionary and system catalog.
Chapter 2 The INFORMATION_SCHEMA ADMINISTRABLE_ROLE_AUTHORIZATIONS Table

The ADMINISTRABLE_ROLE_AUTHORIZATIONS table (available as of MySQL 8.0.19) provides information about which roles applicable for the current user or role can be granted to other users or roles.

The ADMINISTRABLE_ROLE_AUTHORIZATIONS table has these columns:

- **USER**
  The user name part of the current user account.

- **HOST**
  The host name part of the current user account.

- **GRANTEE**
  The user name part of the account to which the role is granted.

- **GRANTEE_HOST**
  The host name part of the account to which the role is granted.

- **ROLE_NAME**
  The user name part of the granted role.

- **ROLE_HOST**
  The host name part of the granted role.

- **IS_GRANTABLE**
  YES or NO, depending on whether the role is grantable to other accounts.

- **IS_DEFAULT**
  YES or NO, depending on whether the role is a default role.

- **IS_MANDATORY**
  YES or NO, depending on whether the role is mandatory.
Chapter 3 The INFORMATION_SCHEMA
APPLICABLE_ROLES Table

The APPLICABLE_ROLES table (available as of MySQL 8.0.19) provides information about the roles that are applicable for the current user.

The APPLICABLE_ROLES table has these columns:

- **USER**
  The user name part of the current user account.

- **HOST**
  The host name part of the current user account.

- **GRANTEE**
  The user name part of the account to which the role is granted.

- **GRANTEE_HOST**
  The host name part of the account to which the role is granted.

- **ROLE_NAME**
  The user name part of the granted role.

- **ROLE_HOST**
  The host name part of the granted role.

- **IS_GRANTABLE**
  YES or NO, depending on whether the role is grantable to other accounts.

- **IS_DEFAULT**
  YES or NO, depending on whether the role is a default role.

- **IS_MANDATORY**
  YES or NO, depending on whether the role is mandatory.
Chapter 4 The INFORMATION_SCHEMA

CHARACTER_SETS Table

The CHARACTER_SETS table provides information about available character sets.

The CHARACTER_SETS table has these columns:

- CHARACTER_SET_NAME
  The character set name.

- DEFAULT_COLLATE_NAME
  The default collation for the character set.

- DESCRIPTION
  A description of the character set.

- MAXLEN
  The maximum number of bytes required to store one character.

Notes

Character set information is also available from the SHOW CHARACTER SET statement. See SHOW CHARACTER SET Statement. The following statements are equivalent:

```
SELECT * FROM INFORMATION_SCHEMA.CHARACTER_SETS
    [WHERE CHARACTER_SET_NAME LIKE 'wild']
SHOW CHARACTER SET
    [LIKE 'wild']
```
The `CHECK_CONSTRAINTS` table (available as of MySQL 8.0.16) provides information about `CHECK` constraints defined on tables.

The `CHECK_CONSTRAINTS` table has these columns:

- **CONSTRAINT_CATALOG**
  
  The name of the catalog to which the constraint belongs. This value is always `def`.

- **CONSTRAINT_SCHEMA**
  
  The name of the schema (database) to which the constraint belongs.

- **CONSTRAINT_NAME**
  
  The name of the constraint.

- **CHECK_CLAUSE**
  
  The expression that specifies the constraint condition.
Chapter 6 The INFORMATION_SCHEMA COLLATIONS Table

The **COLLATIONS** table provides information about collations for each character set.

The **COLLATIONS** table has these columns:

- **COLLATION_NAME**
  
  The collation name.

- **CHARACTER_SET_NAME**
  
  The name of the character set with which the collation is associated.

- **ID**
  
  The collation ID.

- **IS_DEFAULT**
  
  Whether the collation is the default for its character set.

- **IS_COMPILED**
  
  Whether the character set is compiled into the server.

- **SORTLEN**
  
  This is related to the amount of memory required to sort strings expressed in the character set.

- **PAD_ATTRIBUTE**
  
  The collation pad attribute, either **NO_PAD** or **PAD_SPACE**. This attribute affects whether trailing spaces are significant in string comparisons; see Trailing Space Handling in Comparisons.

**Notes**

Collation information is also available from the **SHOW COLLATION** statement. See **SHOW COLLATION Statement**. The following statements are equivalent:

```sql
SELECT COLLATION_NAME FROM INFORMATION_SCHEMA.COLLATIONS
    [WHERE COLLATION_NAME LIKE 'wild']
SHOW COLLATION
    [LIKE 'wild']
```
Chapter 7 The INFORMATION_SCHEMA
COLLATION_CHARACTER_SET_APPLICABILITY Table

The COLLATION_CHARACTER_SET_APPLICABILITY table indicates what character set is applicable for what collation.

The COLLATION_CHARACTER_SET_APPLICABILITY table has these columns:

- **COLLATION_NAME**
  The collation name.

- **CHARACTER_SET_NAME**
  The name of the character set with which the collation is associated.

**Notes**

The COLLATION_CHARACTER_SET_APPLICABILITY columns are equivalent to the first two columns displayed by the SHOW COLLATION statement.
Chapter 8 The INFORMATION_SCHEMA COLUMNS Table

The COLUMNS table provides information about columns in tables. The related ST_GEOMETRY_COLUMNS table provides information about table columns that store spatial data. See Chapter 33, The INFORMATION_SCHEMA ST_GEOMETRY_COLUMNS Table.

The COLUMNS table has these columns:

- **TABLE_CATALOG**
  The name of the catalog to which the table containing the column belongs. This value is always default.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table containing the column belongs.

- **TABLE_NAME**
  The name of the table containing the column.

- **COLUMN_NAME**
  The name of the column.

- **ORDINAL_POSITION**
  The position of the column within the table. ORDINAL_POSITION is necessary because you might want to say ORDER BY ORDINAL_POSITION. Unlike SHOW COLUMNS, SELECT from the COLUMNS table does not have automatic ordering.

- **COLUMN_DEFAULT**
  The default value for the column. This is NULL if the column has an explicit default of NULL, or if the column definition includes no DEFAULT clause.

- **IS_NULLABLE**
  The column nullability. The value is YES if NULL values can be stored in the column, NO if not.

- **DATA_TYPE**
  The column data type.
  The DATA_TYPE value is the type name only with no other information. The COLUMN_TYPE value contains the type name and possibly other information such as the precision or length.

- **CHARACTER_MAXIMUM_LENGTH**
  For string columns, the maximum length in characters.

- **CHARACTER_OCTET_LENGTH**
  For string columns, the maximum length in bytes.

- **NUMERIC_PRECISION**
  For numeric columns, the numeric precision.

- **NUMERIC_SCALE**
  For numeric columns, the numeric scale.

- **DATETIME_PRECISION**
For temporal columns, the fractional seconds precision.

- **CHARACTER_SET_NAME**
  For character string columns, the character set name.

- **COLLATION_NAME**
  For character string columns, the collation name.

- **COLUMN_TYPE**
  The column data type.

  The **DATA_TYPE** value is the type name only with no other information. The **COLUMN_TYPE** value contains the type name and possibly other information such as the precision or length.

- **COLUMN_KEY**
  Whether the column is indexed:
  
  - If **COLUMN_KEY** is empty, the column either is not indexed or is indexed only as a secondary column in a multiple-column, nonunique index.
  
  - If **COLUMN_KEY** is **PRI**, the column is a **PRIMARY KEY** or is one of the columns in a multiple-column **PRIMARY KEY**.
  
  - If **COLUMN_KEY** is **UNI**, the column is the first column of a **UNIQUE** index. (A **UNIQUE** index permits multiple **NULL** values, but you can tell whether the column permits **NULL** by checking the Null column.)
  
  - If **COLUMN_KEY** is **MUL**, the column is the first column of a nonunique index in which multiple occurrences of a given value are permitted within the column.

  If more than one of the **COLUMN_KEY** values applies to a given column of a table, **COLUMN_KEY** displays the one with the highest priority, in the order **PRI**, **UNI**, **MUL**.

  A **UNIQUE** index may be displayed as **PRI** if it cannot contain **NULL** values and there is no **PRIMARY KEY** in the table. A **UNIQUE** index may display as **MUL** if several columns form a composite **UNIQUE** index; although the combination of the columns is unique, each column can still hold multiple occurrences of a given value.

- **EXTRA**
  Any additional information that is available about a given column. The value is nonempty in these cases:
  
  - **auto_increment** for columns that have the **AUTO_INCREMENT** attribute.
  
  - **on update CURRENT_TIMESTAMP** for **TIMESTAMP** or **DATETIME** columns that have the **ON UPDATE CURRENT_TIMESTAMP** attribute.
  
  - **STORED GENERATED** or **VIRTUAL GENERATED** for generated columns.
  
  - **DEFAULT_GENERATED** for columns that have an expression default value.

- **PRIVILEGES**
  The privileges you have for the column.
• **COLUMN_COMMENT**

Any comment included in the column definition.

• **GENERATION_EXPRESSION**

For generated columns, displays the expression used to compute column values. Empty for nongenerated columns. For information about generated columns, see CREATE TABLE and Generated Columns.

• **SRS_ID**

This value applies to spatial columns. It contains the column SRID value that indicates the spatial reference system for values stored in the column. See Spatial Data Types, and Spatial Reference System Support. The value is **NULL** for nonspatial columns and spatial columns with no SRID attribute.

**Notes**

• In **SHOW COLUMNS**, the **Type** display includes values from several different **COLUMNS** columns.

• **CHARACTER_OCTET_LENGTH** should be the same as **CHARACTER_MAXIMUM_LENGTH**, except for multibyte character sets.

• **CHARACTER_SET_NAME** can be derived from **COLLATION_NAME**. For example, if you say **SHOW FULL COLUMNS FROM t**, and you see in the **COLLATION_NAME** column a value of **utf8_swedish_ci**, the character set is what is before the first underscore: **utf8**.

Column information is also available from the **SHOW COLUMNS** statement. See **SHOW COLUMNS Statement**. The following statements are nearly equivalent:

```sql
SELECT COLUMN_NAME, DATA_TYPE, IS_NULLABLE, COLUMN_DEFAULT
FROM INFORMATION_SCHEMA.COLUMNS
WHERE table_name = 'tbl_name'
    [AND table_schema = 'db_name']
    [AND column_name LIKE 'wild']
SHOW COLUMNS
    FROM tbl_name
    [FROM db_name]
    [LIKE 'wild']
```
Chapter 9 The INFORMATION_SCHEMA COLUMN_PRIVILEGES Table

The COLUMN_PRIVILEGES table provides information about column privileges. It takes its values from the mysql.columns_priv system table.

The COLUMN_PRIVILEGES table has these columns:

- **GRANTEE**
  The name of the account to which the privilege is granted, in 'user_name'@'host_name' format.

- **TABLE_CATALOG**
  The name of the catalog to which the table containing the column belongs. This value is always default.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table containing the column belongs.

- **TABLE_NAME**
  The name of the table containing the column.

- **COLUMN_NAME**
  The name of the column.

- **PRIVILEGE_TYPE**
  The privilege granted. The value can be any privilege that can be granted at the column level; see GRANT Statement. Each row lists a single privilege, so there is one row per column privilege held by the grantee.

In the output from SHOW FULL COLUMNS, the privileges are all in one column and in lowercase, for example, select, insert, update, references. In COLUMN_PRIVILEGES, there is one privilege per row, in uppercase.

- **IS_GRANTABLE**
  YES if the user has the GRANT OPTION privilege, NO otherwise. The output does not list GRANT OPTION as a separate row with PRIVILEGE_TYPE='GRANT OPTION'.

Notes

- COLUMN_PRIVILEGES is a nonstandard INFORMATION_SCHEMA table.

The following statements are not equivalent:

```sql
SELECT ... FROM INFORMATION_SCHEMA.COLUMN_PRIVILEGES
SHOW GRANTS ...
```
The **COLUMN_STATISTICS** table provides access to histogram statistics for column values.

For information about histogram statistics, see Optimizer Statistics, and ANALYZE TABLE Statement.

You can see information only for columns for which you have some privilege.

The **COLUMN_STATISTICS** table has these columns:

- **SCHEMA_NAME**
  The names of the schema for which the statistics apply.

- **TABLE_NAME**
  The names of the column for which the statistics apply.

- **COLUMN_NAME**
  The names of the column for which the statistics apply.

- **HISTOGRAM**
  A JSON object describing the column statistics, stored as a histogram.
Chapter 11 The INFORMATION_SCHEMA ENABLED_ROLES Table

The ENABLED_ROLES table (available as of MySQL 8.0.19) provides information about the roles that are enabled within the current session.

The ENABLED_ROLES table has these columns:

- **ROLE_NAME**
  The user name part of the granted role.

- **ROLE_HOST**
  The host name part of the granted role.

- **IS_DEFAULT**
  *YES* or *NO*, depending on whether the role is a default role.

- **IS_MANDATORY**
  *YES* or *NO*, depending on whether the role is mandatory.
Chapter 12 The INFORMATION_SCHEMA ENGINES Table

The ENGINES table provides information about storage engines. This is particularly useful for checking whether a storage engine is supported, or to see what the default engine is.

The ENGINES table has these columns:

- **ENGINE**
  The name of the storage engine.

- **SUPPORT**
  The server's level of support for the storage engine, as shown in the following table.

<table>
<thead>
<tr>
<th>Value</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>The engine is supported and is active</td>
</tr>
<tr>
<td>DEFAULT</td>
<td>Like YES, plus this is the default engine</td>
</tr>
<tr>
<td>NO</td>
<td>The engine is not supported</td>
</tr>
<tr>
<td>DISABLED</td>
<td>The engine is supported but has been disabled</td>
</tr>
</tbody>
</table>

A value of NO means that the server was compiled without support for the engine, so it cannot be enabled at runtime.

A value of DISABLED occurs either because the server was started with an option that disables the engine, or because not all options required to enable it were given. In the latter case, the error log should contain a reason indicating why the option is disabled. See The Error Log.

You might also see DISABLED for a storage engine if the server was compiled to support it, but was started with a --skip-engine_name option. For the NDB storage engine, DISABLED means the server was compiled with support for NDB Cluster, but was not started with the --ndbcluster option.

All MySQL servers support MyISAM tables. It is not possible to disable MyISAM.

- **COMMENT**
  A brief description of the storage engine.

- **TRANSACTIONS**
  Whether the storage engine supports transactions.

- **XA**
  Whether the storage engine supports XA transactions.

- **SAVEPOINTS**
  Whether the storage engine supports savepoints.

**Notes**

- **ENGINES** is a nonstandard INFORMATION_SCHEMA table.

Storage engine information is also available from the `SHOW ENGINES` statement. See SHOW ENGINES Statement. The following statements are equivalent:

```sql
SELECT * FROM INFORMATION_SCHEMA.ENGINES
```
Chapter 13 The INFORMATION_SCHEMA EVENTS Table

The EVENTS table provides information about Event Manager events, which are discussed in Using the Event Scheduler.

The EVENTS table has these columns:

- **EVENT_CATALOG**
  The name of the catalog to which the event belongs. This value is always `def`.

- **EVENT_SCHEMA**
  The name of the schema (database) to which the event belongs.

- **EVENT_NAME**
  The name of the event.

- **DEFINER**
  The account named in the `DEFINER` clause (often the user who created the event), in `user_name@host_name` format.

- **TIME_ZONE**
  The event time zone, which is the time zone used for scheduling the event and that is in effect within the event as it executes. The default value is `SYSTEM`.

- **EVENT_BODY**
  The language used for the statements in the event's `DO` clause. The value is always `SQL`.

- **EVENT_DEFINITION**
  The text of the SQL statement making up the event's `DO` clause; in other words, the statement executed by this event.

- **EVENT_TYPE**
  The event repetition type, either **ONE TIME** (transient) or **RECURRING** (repeating).

- **EXECUTE_AT**
  For a one-time event, this is the `DATETIME` value specified in the `AT` clause of the `CREATE EVENT` statement used to create the event, or of the last `ALTER EVENT` statement that modified the event. The value shown in this column reflects the addition or subtraction of any `INTERVAL` value included in the event's `AT` clause. For example, if an event is created using `ON SCHEDULE AT CURRENT_TIMESTAMP + '1:6' DAY_HOUR`, and the event was created at `2018-02-09 14:05:30`, the value shown in this column would be `'2018-02-10 20:05:30'`. If the event's timing is determined by an `EVERY` clause instead of an `AT` clause (that is, if the event is repeating), the value of this column is `NULL`.

- **INTERVAL_VALUE**
  For a recurring event, the number of intervals to wait between event executions. For a transient event, the value is always `NULL`.

- **INTERVAL_FIELD**
  The time units used for the interval which a recurring event waits before repeating. For a transient event, the value is always `NULL`.
• **SQL_MODE**

The SQL mode in effect when the event was created or altered, and under which the event executes. For the permitted values, see [Server SQL Modes](#).

• **STARTS**

The start date and time for a recurring event. This is displayed as a [DATETIME](#) value, and is [NULL](#) if no start date and time are defined for the event. For a transient event, this column is always [NULL](#). For a recurring event whose definition includes a [STARTS](#) clause, this column contains the corresponding [DATETIME](#) value. As with the [EXECUTE_AT](#) column, this value resolves any expressions used. If there is no [STARTS](#) clause affecting the timing of the event, this column is [NULL](#).

• **ENDS**

For a recurring event whose definition includes a [ENDS](#) clause, this column contains the corresponding [DATETIME](#) value. As with the [EXECUTE_AT](#) column, this value resolves any expressions used. If there is no [ENDS](#) clause affecting the timing of the event, this column is [NULL](#).

• **STATUS**

The event status. One of [ENABLED](#), [DISABLED](#), or [SLAVESIDE_DISABLED](#). [SLAVESIDE_DISABLED](#) indicates that the creation of the event occurred on another MySQL server acting as a replication source and replicated to the current MySQL server which is acting as a replica, but the event is not presently being executed on the replica. For more information, see [Replication of Invoked Features](#).

• **ON_COMPLETION**

One of the two values [PRESERVE](#) or [NOT PRESERVE](#).

• **CREATED**

The date and time when the event was created. This is a [TIMESTAMP](#) value.

• **LAST_ALTERED**

The date and time when the event was last modified. This is a [TIMESTAMP](#) value. If the event has not been modified since its creation, this value is the same as the [CREATED](#) value.

• **LAST_EXECUTED**

The date and time when the event last executed. This is a [DATETIME](#) value. If the event has never executed, this column is [NULL](#).

[LAST_EXECUTED](#) indicates when the event started. As a result, the [ENDS](#) column is never less than [LAST_EXECUTED](#).

• **EVENT_COMMENT**

The text of the comment, if the event has one. If not, this value is empty.

• **ORIGINATOR**

The server ID of the MySQL server on which the event was created; used in replication. This value may be updated by [ALTER EVENT](#) to the server ID of the server on which that statement occurs, if executed on a replication source. The default value is 0.

• **CHARACTER_SET_CLIENT**

The session value of the [character_set_client](#) system variable when the event was created.

• **COLLATION_CONNECTION**
Notes

The session value of the `collation_connection` system variable when the event was created.

- **DATABASE_COLLATION**

  The collation of the database with which the event is associated.

Notes

- **EVENTS** is a nonstandard `INFORMATION_SCHEMA` table.

- Times in the **EVENTS** table are displayed using the event time zone, the current session time zone, or UTC, as described in Event Metadata.

- For more information about `SLAVESIDE_DISABLED` and the `ORIGINATOR` column, see Replication of Invoked Features.

Example

 Suppose that the user `jon@ghidora` creates an event named `e_daily`, and then modifies it a few minutes later using an `ALTER EVENT` statement, as shown here:

```
DELIMITER |
CREATE EVENT e_daily
ON SCHEDULE
EVERY 1 DAY
COMMENT 'Saves total number of sessions then clears the table each day'
DO
BEGIN
    INSERT INTO site_activity.totals (time, total)
    SELECT CURRENT_TIMESTAMP, COUNT(*)
    FROM site_activity.sessions;
    DELETE FROM site_activity.sessions;
END |
DELIMITER ;
ALTER EVENT e_daily
ENABLE;
```

(Note that comments can span multiple lines.)

This user can then run the following **SELECT** statement, and obtain the output shown:

```
mysql> SELECT * FROM INFORMATION_SCHEMA.EVENTS
    WHERE EVENT_NAME = 'e_daily' AND EVENT_SCHEMA = 'myschema'
G
*************************** 1. row ***************************
EVENT_CATALOG: def
EVENT_SCHEMA: myschema
EVENT_NAME: e_daily
DEFINER: jon@ghidora
TIME_ZONE: SYSTEM
EVENT_BODY: SQL
EVENT_DEFINITION: BEGIN
    INSERT INTO site_activity.totals (time, total)
    SELECT CURRENT_TIMESTAMP, COUNT(*)
    FROM site_activity.sessions;
    DELETE FROM site_activity.sessions;
END
EVENT_TYPE: RECURRING
EXECUTE_AT: NULL
INTERVAL_VALUE: 1
INTERVAL_FIELD: DAY
SQL_MODE: ONLY_FULL_GROUP_BY, STRICT_TRANS_TABLES,
NO_ZERO_IN_DATE, NO_ZERO_DATE,
ERROR_FOR_DIVISION_BY_ZERO,
NO_ENGINE_SUBSTITUTION
STARTS: 2018-08-08 11:06:34
ENDS: NULL
```
Event information is also available from the SHOW EVENTS statement. See SHOW EVENTS Statement.

The following statements are equivalent:

```sql
SELECT EVENT_SCHEMA, EVENT_NAME, DEFINER, TIME_ZONE, EVENT_TYPE, EXECUTE_AT, INTERVAL_VALUE, INTERVAL_FIELD, STARTS, ENDS, STATUS, ORIGINATOR, CHARACTER_SET_CLIENT, COLLATION_CONNECTION, DATABASE_COLLATION
FROM INFORMATION_SCHEMA.EVENTS
WHERE table_schema = 'db_name'
[AND column_name LIKE 'wild']
SHOW EVENTS
[FROM db_name]
[LIKE 'wild']
```
Chapter 14 The INFORMATION_SCHEMA FILES Table

The FILES table provides information about the files in which MySQL tablespace data is stored.

The FILES table provides information about InnoDB data files. In NDB Cluster, this table also provides information about the files in which NDB Cluster Disk Data tables are stored. For additional information specific to InnoDB, see InnoDB Notes, later in this section; for additional information specific to NDB Cluster, see NDB Notes.

The FILES table has these columns:

- **FILE_ID**
  For InnoDB: The tablespace ID, also referred to as the space_id or fil_space_t::id.
  For NDB: A file identifier. FILE_ID column values are auto-generated.

- **FILE_NAME**
  For InnoDB: The name of the data file. File-per-table and general tablespaces have an .ibd file name extension. Undo tablespaces are prefixed by undo. The system tablespace is prefixed by ibdata. The global temporary tablespace is prefixed by ibtmp. The file name includes the file path, which may be relative to the MySQL data directory (the value of the datadir system variable).
  For NDB: The name of an undo log file created by CREATE LOGFILE GROUP or ALTER LOGFILE GROUP, or of a data file created by CREATE TABLESPACE or ALTER TABLESPACE. In NDB 8.0, the file name is shown with a relative path; for an undo log file, this path is relative to the directory DataDir/ndb_NodeId_fs/LG; for a data file, it is relative to the directory DataDir/ndb_NodeId_fs/TS. This means, for example, that the name of a data file created with ALTER TABLESPACE ts ADD DATAFILE 'data_2.dat' INITIAL SIZE 256M is shown as ./data_2.dat.

- **FILE_TYPE**
  For InnoDB: The tablespace file type. There are three possible file types for InnoDB files.
  TABLESPACE is the file type for any system, general, or file-per-table tablespace file that holds tables, indexes, or other forms of user data. TEMPORARY is the file type for temporary tablespaces. UNDO LOG is the file type for undo tablespaces, which hold undo records.
  For NDB: One of the values UNDO LOG or DATAFILE. Prior to NDB 8.0.13, TABLESPACE was also a possible value.

- **TABLESPACE_NAME**
  For InnoDB: The SQL name for the tablespace. A general tablespace name is the SYS_TABLESPACES.NAME value. For other tablespace files, names start with innodb_, such as innodb_system, innodb_undo, and innodb_file_per_table. The file-per-table tablespace name format is innodb_file_per_table_##, where ## is the tablespace ID.
  For NDB: The name of the tablespace with which the file is associated.

- **TABLE_CATALOG**
  This value is always empty.

- **TABLE_SCHEMA**
  This is always NULL.

- **TABLE_NAME**
  This is always NULL.
• **LOGFILE_GROUP_NAME**
  
  For **InnoDB**: This is always **NULL**.
  
  For **NDB**: The name of the log file group to which the log file or data file belongs.

• **LOGFILE_GROUP_NUMBER**
  
  For **InnoDB**: This is always **NULL**.
  
  For **NDB**: For a Disk Data undo log file, the auto-generated ID number of the log file group to which the log file belongs. This is the same as the value shown for the `id` column in the `ndbinfo.dict_obj_info` table and the `log_id` column in the `ndbinfo.logspaces` and `ndbinfo.logspaces` tables for this undo log file.

• **ENGINE**
  
  For **InnoDB**: This value is always **InnoDB**.
  
  For **NDB**: This value is always **ndbcluster**.

• **FULLTEXT_KEYS**
  
  This is always **NULL**.

• **DELETED_ROWS**
  
  This is always **NULL**.

• **UPDATE_COUNT**
  
  This is always **NULL**.

• **FREE_EXTENTS**
  
  For **InnoDB**: The number of fully free extents in the current data file.
  
  For **NDB**: The number of extents which have not yet been used by the file.

• **TOTAL_EXTENTS**
  
  For **InnoDB**: The number of full extents used in the current data file. Any partial extent at the end of the file is not counted.
  
  For **NDB**: The total number of extents allocated to the file.

• **EXTENT_SIZE**
  
  For **InnoDB**: Extent size is 1048576 (1MB) for files with a 4KB, 8KB, or 16KB page size. Extent size is 2097152 bytes (2MB) for files with a 32KB page size, and 4194304 (4MB) for files with a 64KB page size. **FILES** does not report **InnoDB** page size. Page size is defined by the `innodb_page_size` system variable. Extent size information can also be retrieved from the `INNODB_TABLESPACES` table where `FILES.FILE_ID = INNODB_TABLESPACES.SPACE`.
  
  For **NDB**: The size of an extent for the file in bytes.

• **INITIAL_SIZE**
  
  For **InnoDB**: The initial size of the file in bytes.
  
  For **NDB**: The size of the file in bytes. This is the same value that was used in the `INITIAL_SIZE` clause of the `CREATE LOGFILE GROUP, ALTER LOGFILE GROUP, CREATE TABLESPACE, or ALTER TABLESPACE` statement used to create the file.
• **MAXIMUM_SIZE**

For *InnoDB*: The maximum number of bytes permitted in the file. The value is **NULL** for all data files except for predefined system tablespace data files. Maximum system tablespace file size is defined by `innodb_data_file_path`. Maximum global temporary tablespace file size is defined by `innodb_temp_data_file_path`. A **NULL** value for a predefined system tablespace data file indicates that a file size limit was not defined explicitly.

For *NDB*: This value is always the same as the **INITIAL_SIZE** value.

• **AUTOEXTEND_SIZE**

For *InnoDB*: **AUTOEXTEND_SIZE** is the auto-extend size defined by `innodb_data_file_path` for the system tablespace, or by `innodb_temp_data_file_path` for the global temporary tablespace.

For *NDB*: This is always **NULL**.

• **CREATION_TIME**

  This is always **NULL**.

• **LAST_UPDATE_TIME**

  This is always **NULL**.

• **LAST_ACCESS_TIME**

  This is always **NULL**.

• **RECOVER_TIME**

  This is always **NULL**.

• **TRANSACTION_COUNTER**

  This is always **NULL**.

• **VERSION**

  For *InnoDB*: This is always **NULL**.

  For *NDB*: The version number of the file.

• **ROW_FORMAT**

  For *InnoDB*: This is always **NULL**.

  For *NDB*: One of **FIXED** or **DYNAMIC**.

• **TABLE_ROWS**

  This is always **NULL**.

• **AVG_ROW_LENGTH**

  This is always **NULL**.

• **DATA_LENGTH**

  This is always **NULL**.

• **MAX_DATA_LENGTH**

  This is always **NULL**.
This is always **NULL**.

- **INDEX_LENGTH**
  This is always **NULL**.

- **DATA_FREE**
  For **InnoDB**: The total amount of free space (in bytes) for the entire tablespace. Predefined system tablespaces, which include the system tablespace and temporary table tablespaces, may have one or more data files.
  For **NDB**: This is always **NULL**.

- **CREATE_TIME**
  This is always **NULL**.

- **UPDATE_TIME**
  This is always **NULL**.

- **CHECK_TIME**
  This is always **NULL**.

- **CHECKSUM**
  This is always **NULL**.

- **STATUS**
  For **InnoDB**: This value is **NORMAL** by default. **InnoDB** file-per-table tablespaces may report **IMPORTING**, which indicates that the tablespace is not yet available.
  For **NDB**: For NDB Cluster Disk Data files, this value is always **NORMAL**.

- **EXTRA**
  For **InnoDB**: This is always **NULL**.
  For **NDB**: (**NDB 8.0.15 and later**) For undo log files, this column shows the undo log buffer size; for data files, it is always **NULL**. A more detailed explanation is provided in the next few paragraphs.

**NDBCluster** stores a copy of each data file and each undo log file on each data node in the cluster. In **NDB 8.0.13** and later, the **FILES** table contains only one row for each such file. Suppose that you run the following two statements on an NDB Cluster with four data nodes:

```sql
CREATE LOGFILE GROUP mygroup
  ADD UNDOFILE 'new_undo.dat'
  INITIAL_SIZE 2G
  ENGINE NDBCLUSTER;
CREATE TABLESPACE myts
  ADD DATAFILE 'data_1.dat'
  USE LOGFILE GROUP mygroup
  INITIAL_SIZE 256M
  ENGINE NDBCLUSTER;
```

After running these two statements successfully, you should see a result similar to the one shown here for this query against the **FILES** table:

```sql
mysql> SELECT LOGFILE_GROUP_NAME, FILE_TYPE, EXTRA
    -> FROM INFORMATION_SCHEMA.FILES
    -> WHERE ENGINE = 'ndbcluster';
```

---

34
The undo log buffer size information was inadvertently removed in NDB 8.0.13, but was restored in NDB 8.0.15. (Bug #92796, Bug #28800252)

Prior to NDB 8.0.13, the `FILES` table contained a row for each of these files on each data node the file belonged to, as well as the size of its undo buffer. In these versions, the result of the same query contains one row per data node, as shown here:

<table>
<thead>
<tr>
<th>LOGFILE_GROUP_NAME</th>
<th>FILE_TYPE</th>
<th>EXTRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>mygroup</td>
<td>UNDO LOG</td>
<td>CLUSTER_NODE=5;UNDO_BUFFER_SIZE=8388608</td>
</tr>
<tr>
<td>mygroup</td>
<td>UNDO LOG</td>
<td>CLUSTER_NODE=6;UNDO_BUFFER_SIZE=8388608</td>
</tr>
<tr>
<td>mygroup</td>
<td>UNDO LOG</td>
<td>CLUSTER_NODE=7;UNDO_BUFFER_SIZE=8388608</td>
</tr>
<tr>
<td>mygroup</td>
<td>UNDO LOG</td>
<td>CLUSTER_NODE=8;UNDO_BUFFER_SIZE=8388608</td>
</tr>
<tr>
<td>mygroup</td>
<td>DATAFILE</td>
<td>CLUSTER_NODE=5</td>
</tr>
<tr>
<td>mygroup</td>
<td>DATAFILE</td>
<td>CLUSTER_NODE=6</td>
</tr>
<tr>
<td>mygroup</td>
<td>DATAFILE</td>
<td>CLUSTER_NODE=7</td>
</tr>
<tr>
<td>mygroup</td>
<td>DATAFILE</td>
<td>CLUSTER_NODE=8</td>
</tr>
</tbody>
</table>

Notes

- `FILES` is a nonstandard `INFORMATION_SCHEMA` table.
- As of MySQL 8.0.21, you must have the `PROCESS` privilege to query this table.

**InnoDB Notes**

The following notes apply to InnoDB data files.

- Data reported by `FILES` is reported from the InnoDB in-memory cache for open files. By comparison, `INNODB_DATAFILES` reports data from the InnoDB `SYS_DATAFILES` internal data dictionary table.
- The data reported by `FILES` includes global temporary tablespace data. This data is not available in the InnoDB `SYS_DATAFILES` internal data dictionary table, and is therefore not reported by `INNODB_DATAFILES`.
- Undo tablespace data is reported by `FILES` when separate undo tablespaces are present, which they are by default in MySQL 8.0.
- The following query returns all data pertinent to InnoDB tablespaces.

```sql
SELECT FILE_ID, FILE_NAME, FILE_TYPE, TABLESPACE_NAME, FREE_EXTENTS, TOTAL_EXTENTS, EXTENT_SIZE, INITIAL_SIZE, MAXIMUM_SIZE, AUTOEXTEND_SIZE, DATA_FREE, STATUS
FROM INFORMATION_SCHEMA.FILES WHERE ENGINE='InnoDB'
```

NDB Notes

- The `FILES` table provides information about Disk Data files only; you cannot use it for determining disk space allocation or availability for individual NDB tables. However, it is possible to see how much space is allocated for each NDB table having data stored on disk—as well as how much remains available for storage of data on disk for that table—using `ndb_desc`.
- The `CREATION_TIME`, `LAST_UPDATE_TIME`, and `LAST_ACCESSED` values are as reported by the operating system, and are not supplied by the NDB storage engine. Where no value is provided by the operating system, these columns display `NULL`.

35
The difference between the `TOTAL_EXTENTS` and `FREE_EXTENTS` columns is the number of extents currently in use by the file:

```sql
SELECT TOTAL_EXTENTS - FREE_EXTENTS AS extents_used
FROM INFORMATION_SCHEMA.FILES
WHERE FILE_NAME = './myfile.dat';
```

To approximate the amount of disk space in use by the file, multiply that difference by the value of the `EXTENT_SIZE` column, which gives the size of an extent for the file in bytes:

```sql
SELECT (TOTAL_EXTENTS - FREE_EXTENTS) * EXTENT_SIZE AS bytes_used
FROM INFORMATION_SCHEMA.FILES
WHERE FILE_NAME = './myfile.dat';
```

Similarly, you can estimate the amount of space that remains available in a given file by multiplying `FREE_EXTENTS` by `EXTENT_SIZE`:

```sql
SELECT FREE_EXTENTS * EXTENT_SIZE AS bytes_free
FROM INFORMATION_SCHEMA.FILES
WHERE FILE_NAME = './myfile.dat';
```

**Important**

The byte values produced by the preceding queries are approximations only, and their precision is inversely proportional to the value of `EXTENT_SIZE`. That is, the larger `EXTENT_SIZE` becomes, the less accurate the approximations are.

It is also important to remember that once an extent is used, it cannot be freed again without dropping the data file of which it is a part. This means that deletes from a Disk Data table do not release disk space.

The extent size can be set in a `CREATE TABLESPACE` statement. For more information, see the description of this table as well as **NDB Cluster Disk Data Objects**, for more information.

Prior to NDB 8.0.13, an additional row was present in the `FILES` table following the creation of a logfile group, having `NULL` in the `FILE_NAME` column. In NDB 8.0.13 and later, this row — which did not correspond to any file—is no longer shown, and it is necessary to query the ndbinfo.logspaces table to obtain undo log file usage information. See the description of this table as well as **NDB Cluster Disk Data Objects**, for more information.

The remainder of the discussion in this item applies only to NDB 8.0.12 and earlier. For the row having `NULL` in the `FILE_NAME` column, the value of the `FILE_ID` column is always 0, that of the `FILE_TYPE` column is always `UNDO LOG`, and that of the `STATUS` column is always `NORMAL`. The value of the `ENGINE` column is always `ndbcluster`.

The `FREE_EXTENTS` column in this row shows the total number of free extents available to all undo files belonging to a given log file group whose name and number are shown in the `LOGFILE_GROUP_NAME` and `LOGFILE_GROUP_NUMBER` columns, respectively.

Suppose there are no existing log file groups on your NDB Cluster, and you create one using the following statement:

```sql
mysql>
CREATE LOGFILE GROUP lg1
ADD UNDOFILE 'undofile.dat'
INITIAL_SIZE = 16M
UNDO_BUFFER_SIZE = 1M
ENGINE = NDB;
```

You can now see this `NULL` row when you query the `FILES` table:

```sql
mysql>
SELECT DISTINCT
FILE_NAME AS File,
FREE_EXTENTS AS Free,
```
The total number of free extents available for undo logging is always somewhat less than the sum of the `TOTAL_EXTENTS` column values for all undo files in the log file group due to overhead required for maintaining the undo files. This can be seen by adding a second undo file to the log file group, then repeating the previous query against the `FILES` table:

```
mysql> ALTER LOGFILE GROUP lg1
    ADD UNDOFILE 'undofile02.dat'
    INITIAL_SIZE = 4M
    ENGINE = NDB;

mysql> SELECT DISTINCT
    FILE_NAME AS File,
    FREE_EXTENTS AS Free,
    TOTAL_EXTENTS AS Total,
    EXTENT_SIZE AS Size,
    INITIAL_SIZE AS Initial
    FROM INFORMATION_SCHEMA.FILES;
```

The amount of free space in bytes which is available for undo logging by Disk Data tables using this log file group can be approximated by multiplying the number of free extents by the initial size:

```
mysql> SELECT
    FREE_EXTENTS AS 'Free Extents',
    FREE_EXTENTS * EXTENT_SIZE AS 'Free Bytes'
    FROM INFORMATION_SCHEMA.FILES
    WHERE LOGFILE_GROUP_NAME = 'lg1'
    AND FILE_NAME IS NULL;
```

If you create an NDB Cluster Disk Data table and then insert some rows into it, you can see approximately how much space remains for undo logging afterward, for example:

```
mysql> CREATE TABLESPACE ts1
    ADD DATAFILE 'data1.dat'
    USE LOGFILE GROUP lg1
    INITIAL_SIZE 512M
    ENGINE = NDB;

mysql> CREATE TABLE dd (c1 INT NOT NULL PRIMARY KEY, c2 INT, c3 DATE)
    TABLESPACE ts1 STORAGE DISK
    ENGINE = NDB;

mysql> INSERT INTO dd VALUES
    (NULL, 1234567890, '2007-02-02'),
    (NULL, 1126789005, '2007-02-03'),
    (NULL, 1357924680, '2007-02-04'),
    (NULL, 1642097531, '2007-02-05');
```
SELECT FREE_EXTENTS AS 'Free Extents',
       FREE_EXTENTS * EXTENT_SIZE AS 'Free Bytes'
FROM INFORMATION_SCHEMA.FILES
WHERE LOGFILE_GROUP_NAME = 'lg1'
       AND FILE_NAME IS NULL;

+--------------+------------+
<table>
<thead>
<tr>
<th>Free Extents</th>
<th>Free Bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5207565</td>
<td>20830260</td>
</tr>
</tbody>
</table>

• Prior to NDB 8.0.13, an additional row was present in the FILES table for each NDB Cluster Disk Data tablespace. Because it did not correspond to an actual file, it was removed in NDB 8.0.13. This row had NULL for the value of the FILE_NAME column, the value of the FILE_ID column was always 0, that of the FILE_TYPE column was always TABLESPACE, that of the STATUS column was always NORMAL, and the value of the ENGINE column is always NDBCLUSTER.

In NDB 8.0.13 and later, you can obtain information about Disk Data tablespaces using the ndb_desc utility. For more information, see NDB Cluster Disk Data Objects, as well as the description of ndb_desc.

• For additional information, and examples of creating, dropping, and obtaining information about NDB Cluster Disk Data objects, see NDB Cluster Disk Data Tables.
Chapter 15 The INFORMATION_SCHEMA KEY_COLUMN_USAGE Table

The KEY_COLUMN_USAGE table describes which key columns have constraints. This table provides no information about functional key parts because they are expressions and the table provides information only about columns.

The KEY_COLUMN_USAGE table has these columns:

- **CONSTRAINT_CATALOG**
  The name of the catalog to which the constraint belongs. This value is always def.

- **CONSTRAINT_SCHEMA**
  The name of the schema (database) to which the constraint belongs.

- **CONSTRAINT_NAME**
  The name of the constraint.

- **TABLE_CATALOG**
  The name of the catalog to which the table belongs. This value is always def.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table belongs.

- **TABLE_NAME**
  The name of the table that has the constraint.

- **COLUMN_NAME**
  The name of the column that has the constraint.

  If the constraint is a foreign key, then this is the column of the foreign key, not the column that the foreign key references.

- **ORDINAL_POSITION**
  The column's position within the constraint, not the column's position within the table. Column positions are numbered beginning with 1.

- **POSITION_IN_UNIQUE_CONSTRAINT**
  NULL for unique and primary-key constraints. For foreign-key constraints, this column is the ordinal position in key of the table that is being referenced.

- **REFERENCED_TABLE_SCHEMA**
  The name of the schema referenced by the constraint.

- **REFERENCED_TABLE_NAME**
  The name of the table referenced by the constraint.

- **REFERENCED_COLUMN_NAME**
  The name of the column referenced by the constraint.
Suppose that there are two tables name \texttt{t1} and \texttt{t3} that have the following definitions:

\begin{verbatim}
CREATE TABLE t1
(
  s1 INT,
s2 INT,
s3 INT,
  PRIMARY KEY(s3)
) ENGINE=InnoDB;

CREATE TABLE t3
(
  s1 INT,
s2 INT,
s3 INT,
  KEY(s1),
  CONSTRAINT CO FOREIGN KEY (s2) REFERENCES t1(s3)
) ENGINE=InnoDB;
\end{verbatim}

For those two tables, the \texttt{KEY_COLUMN_USAGE} table has two rows:

- One row with \texttt{CONSTRAINT_NAME = 'PRIMARY', TABLE_NAME = 't1', COLUMN_NAME = 's3', ORDINAL_POSITION = 1, POSITION_IN_UNIQUE_CONSTRAINT = NULL.}

  For \texttt{NDB}: This value is always \texttt{NULL}.

- One row with \texttt{CONSTRAINT_NAME = 'CO', TABLE_NAME = 't3', COLUMN_NAME = 's2', ORDINAL_POSITION = 1, POSITION_IN_UNIQUE_CONSTRAINT = 1.}
Chapter 16 The INFORMATION_SCHEMA KEYWORDS Table

The `KEYWORDS` table lists the words considered keywords by MySQL and, for each one, indicates whether it is reserved. Reserved keywords may require special treatment in some contexts, such as special quoting when used as identifiers (see Keywords and Reserved Words). This table provides applications a runtime source of MySQL keyword information.

Prior to MySQL 8.0.13, selecting from the `KEYWORDS` table with no default database selected produced an error. (Bug #90160, Bug #27729859)

The `KEYWORDS` table has these columns:

- **WORD**
  The keyword.

- **RESERVED**
  An integer indicating whether the keyword is reserved (1) or nonreserved (0).

These queries lists all keywords, all reserved keywords, and all nonreserved keywords, respectively:

```
SELECT * FROM INFORMATION_SCHEMA.KEYWORDS;
SELECT WORD FROM INFORMATION_SCHEMA.KEYWORDS WHERE RESERVED = 1;
SELECT WORD FROM INFORMATION_SCHEMA.KEYWORDS WHERE RESERVED = 0;
```

The latter two queries are equivalent to:

```
SELECT WORD FROM INFORMATION_SCHEMA.KEYWORDS WHERE RESERVED;
SELECT WORD FROM INFORMATION_SCHEMA.KEYWORDS WHERE NOT RESERVED;
```

If you build MySQL from source, the build process generates a `keyword_list.h` header file containing an array of keywords and their reserved status. This file can be found in the `sql` directory under the build directory. This file may be useful for applications that require a static source for the keyword list.
Chapter 17 The INFORMATION_SCHEMA
OPTIMIZER_TRACE Table

The `OPTIMIZER_TRACE` table provides information produced by the optimizer tracing capability for traced statements. To enable tracking, use the `optimizer_trace` system variable. For details, see MySQL Internals: Tracing the Optimizer.

The `OPTIMIZER_TRACE` table has these columns:

- **QUERY**
  The text of the traced statement.

- **TRACE**
  The trace, in JSON format.

- **MISSING_BYTES_BEYOND_MAX_MEM_SIZE**
  Each remembered trace is a string that is extended as optimization progresses and appends data to it. The `optimizer_trace_max_mem_size` variable sets a limit on the total amount of memory used by all currently remembered traces. If this limit is reached, the current trace is not extended (and thus is incomplete), and the `MISSING_BYTES_BEYOND_MAX_MEM_SIZE` column shows the number of bytes missing from the trace.

- **INSUFFICIENT_PRIVILEGES**
  If a traced query uses views or stored routines that have SQL SECURITY with a value of DEFINER, it may be that a user other than the definer is denied from seeing the trace of the query. In that case, the trace is shown as empty and `INSUFFICIENT_PRIVILEGES` has a value of 1. Otherwise, the value is 0.
### Chapter 18 The INFORMATION_SCHEMA PARAMETERS Table

The **PARAMETERS** table provides information about parameters for stored routines (stored procedures and stored functions), and about return values for stored functions. The **PARAMETERS** table does not include built-in SQL functions or user-defined functions (UDFs).

The **PARAMETERS** table has these columns:

- **SPECIFIC_CATALOG**
  The name of the catalog to which the routine containing the parameter belongs. This value is always **def**.

- **SPECIFIC_SCHEMA**
  The name of the schema (database) to which the routine containing the parameter belongs.

- **SPECIFIC_NAME**
  The name of the routine containing the parameter.

- **ORDINAL_POSITION**
  For successive parameters of a stored procedure or function, the **ORDINAL_POSITION** values are 1, 2, 3, and so forth. For a stored function, there is also a row that applies to the function return value (as described by the **RETURNS** clause). The return value is not a true parameter, so the row that describes it has these unique characteristics:

  - The **ORDINAL_POSITION** value is 0.
  - The **PARAMETER_NAME** and **PARAMETER_MODE** values are **NULL** because the return value has no name and the mode does not apply.

- **PARAMETER_MODE**
  The mode of the parameter. This value is one of **IN**, **OUT**, or **INOUT**. For a stored function return value, this value is **NULL**.

- **PARAMETER_NAME**
  The name of the parameter. For a stored function return value, this value is **NULL**.

- **DATA_TYPE**
  The parameter data type.

  The **DATA_TYPE** value is the type name only with no other information. The **DTD_IDENTIFIER** value contains the type name and possibly other information such as the precision or length.

- **CHARACTER_MAXIMUM_LENGTH**
  For string parameters, the maximum length in characters.

- **CHARACTER_OCTET_LENGTH**
  For string parameters, the maximum length in bytes.

- **NUMERIC_PRECISION**
  For numeric parameters, the numeric precision.
• **NUMERIC_SCALE**
  For numeric parameters, the numeric scale.

• **DATETIME_PRECISION**
  For temporal parameters, the fractional seconds precision.

• **CHARACTER_SET_NAME**
  For character string parameters, the character set name.

• **COLLATION_NAME**
  For character string parameters, the collation name.

• **DTD_IDENTIFIER**
  The parameter data type.
  The **DATA_TYPE** value is the type name only with no other information. The **DTD_IDENTIFIER** value contains the type name and possibly other information such as the precision or length.

• **ROUTINE_TYPE**
  **PROCEDURE** for stored procedures, **FUNCTION** for stored functions.
Chapter 19 The INFORMATION_SCHEMA PARTITIONS Table

The PARTITIONS table provides information about table partitions. Each row in this table corresponds to an individual partition or subpartition of a partitioned table. For more information about partitioning tables, see Partitioning.

The PARTITIONS table has these columns:

- **TABLE_CATALOG**
  The name of the catalog to which the table belongs. This value is always `def`.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table belongs.

- **TABLE_NAME**
  The name of the table containing the partition.

- **PARTITION_NAME**
  The name of the partition.

- **SUBPARTITION_NAME**
  If the PARTITIONS table row represents a subpartition, the name of subpartition; otherwise `NULL`. For NDB: This value is always `NULL`.

- **PARTITION_ORDINAL_POSITION**
  All partitions are indexed in the same order as they are defined, with `1` being the number assigned to the first partition. The indexing can change as partitions are added, dropped, and reorganized; the number shown is this column reflects the current order, taking into account any indexing changes.

- **SUBPARTITION_ORDINAL_POSITION**
  Subpartitions within a given partition are also indexed and reindexed in the same manner as partitions are indexed within a table.

- **PARTITION_METHOD**
  One of the values `RANGE`, `LIST`, `HASH`, `LINEAR_HASH`, `KEY`, or `LINEAR_KEY`; that is, one of the available partitioning types as discussed in Partitioning Types.

- **SUBPARTITION_METHOD**
  One of the values `HASH`, `LINEAR_HASH`, `KEY`, or `LINEAR_KEY`; that is, one of the available subpartitioning types as discussed in Subpartitioning.

- **PARTITION_EXPRESSION**
  The expression for the partitioning function used in the CREATE TABLE or ALTER TABLE statement that created the table's current partitioning scheme.

For example, consider a partitioned table created in the `test` database using this statement:

```
cREATE TABLE tp (
    c1 INT,
    c2 INT,
    c3 VARCHAR(25)
```
PARTITION BY HASH(c1 + c2)
PARTITIONS 4;

The PARTITION_EXPRESSION column in a PARTITIONS table row for a partition from this table displays c1 + c2, as shown here:

```
mysql> SELECT DISTINCT PARTITION_EXPRESSION
                FROM INFORMATION_SCHEMA.PARTITIONS
                WHERE TABLE_NAME='tp' AND TABLE_SCHEMA='test';
```
```
+----------------------+
| PARTITION_EXPRESSION |
+----------------------+
| c1 + c2              |
+----------------------+
```

• **SUBPARTITION_EXPRESSION**

This works in the same fashion for the subpartitioning expression that defines the subpartitioning for a table as PARTITION_EXPRESSION does for the partitioning expression used to define a table's partitioning.

If the table has no subpartitions, this column is NULL.

• **PARTITION_DESCRIPTION**

This column is used for RANGE and LIST partitions. For a RANGE partition, it contains the value set in the partition's VALUES LESS THAN clause, which can be either an integer or MAXVALUE. For a LIST partition, this column contains the values defined in the partition's VALUES IN clause, which is a list of comma-separated integer values.

For partitions whose PARTITION_METHOD is other than RANGE or LIST, this column is always NULL.

• **TABLE_ROWS**

The number of table rows in the partition.

For partitioned InnoDB tables, the row count given in the TABLE_ROWS column is only an estimated value used in SQL optimization, and may not always be exact.

For NDB tables, you can also obtain this information using the ndb_desc utility.

• **AVG_ROW_LENGTH**

The average length of the rows stored in this partition or subpartition, in bytes. This is the same as DATA_LENGTH divided by TABLE_ROWS.

For NDB tables, you can also obtain this information using the ndb_desc utility.

• **DATA_LENGTH**

The total length of all rows stored in this partition or subpartition, in bytes; that is, the total number of bytes stored in the partition or subpartition.

For NDB tables, you can also obtain this information using the ndb_desc utility.

• **MAX_DATA_LENGTH**

The maximum number of bytes that can be stored in this partition or subpartition.

For NDB tables, you can also obtain this information using the ndb_desc utility.

• **INDEX_LENGTH**

The length of the index file for this partition or subpartition, in bytes.
For partitions of NDB tables, whether the tables use implicit or explicit partitioning, the INDEX_LENGTH column value is always 0. However, you can obtain equivalent information using the ndb_desc utility.

- **DATA_FREE**
The number of bytes allocated to the partition or subpartition but not used. For NDB tables, you can also obtain this information using the ndb_desc utility.

- **CREATE_TIME**
The time that the partition or subpartition was created.

- **UPDATE_TIME**
The time that the partition or subpartition was last modified.

- **CHECK_TIME**
The last time that the table to which this partition or subpartition belongs was checked. For partitioned InnoDB tables, the value is always NULL.

- **CHECKSUM**
The checksum value, if any; otherwise NULL.

- **PARTITION_COMMENT**
The text of the comment, if the partition has one. If not, this value is empty.

  The maximum length for a partition comment is defined as 1024 characters, and the display width of the PARTITION_COMMENT column is also 1024, characters to match this limit.

- **NODEGROUP**
This is the nodegroup to which the partition belongs. This is relevant only to NDB Cluster tables; otherwise, the value is always 0.

- **TABLESPACE_NAME**
The name of the tablespace to which the partition belongs. The value is always DEFAULT, unless the table uses the NDB storage engine (see the Notes at the end of this section).

### Notes

- **PARTITIONS** is a nonstandard INFORMATION_SCHEMA table.

  - A table using any storage engine other than NDB and which is not partitioned has one row in the PARTITIONS table. However, the values of the PARTITION_NAME, SUBPARTITION_NAME, PARTITION_ORDINAL_POSITION, SUBPARTITION_ORDINAL_POSITION, PARTITION_METHOD, SUBPARTITION_METHOD, PARTITION_EXPRESSION, SUBPARTITION_EXPRESSION, and PARTITION_DESCRIPTION columns are all NULL. Also, the PARTITION_COMMENT column in this case is blank.

  - An NDB table which is not explicitly partitioned has one row in the PARTITIONS table for each data node in the NDB cluster. For each such row:

    - The SUBPARTITION_NAME, SUBPARTITION_ORDINAL_POSITION, SUBPARTITION_METHOD, PARTITION_EXPRESSION, SUBPARTITION_EXPRESSION, CREATE_TIME, UPDATE_TIME, CHECK_TIME, CHECKSUM, and TABLESPACE_NAME columns are all NULL.
• The PARTITION_METHOD is always AUTO.
• The NODEGROUP column is default.
• The PARTITION_EXPRESSION and PARTITION_COMMENT columns are empty.
Chapter 20 The INFORMATION_SCHEMA PLUGINS Table

The PLUGINS table provides information about server plugins.

The PLUGINS table has these columns:

- **PLUGIN_NAME**
  The name used to refer to the plugin in statements such as INSTALL PLUGIN and UNINSTALL PLUGIN.

- **PLUGIN_VERSION**
  The version from the plugin's general type descriptor.

- **PLUGIN_STATUS**
  The plugin status, one of ACTIVE, INACTIVE, DISABLED, DELETING, or DELETED.

- **PLUGIN_TYPE**
  The type of plugin, such as STORAGE ENGINE, INFORMATION_SCHEMA, or AUTHENTICATION.

- **PLUGIN_TYPE_VERSION**
  The version from the plugin's type-specific descriptor.

- **PLUGIN_LIBRARY**
  The name of the plugin shared library file. This is the name used to refer to the plugin file in statements such as INSTALL PLUGIN and UNINSTALL PLUGIN. This file is located in the directory named by the plugin_dir system variable. If the library name is NULL, the plugin is compiled in and cannot be uninstalled with UNINSTALL PLUGIN.

- **PLUGIN_LIBRARY_VERSION**
  The plugin API interface version.

- **PLUGIN_AUTHOR**
  The plugin author.

- **PLUGIN_DESCRIPTION**
  A short description of the plugin.

- **PLUGIN_LICENSE**
  How the plugin is licensed (for example, GPL).

- **LOAD_OPTION**
  How the plugin was loaded. The value is OFF, ON, FORCE, or FORCE_PLUS_PERMANENT. See Installing and Uninstalling Plugins.

Notes

- **PLUGINS** is a nonstandard INFORMATION_SCHEMA table.

- For plugins installed with INSTALL PLUGIN, the PLUGIN_NAME and PLUGIN_LIBRARY values are also registered in the mysql.plugin table.

- For information about plugin data structures that form the basis of the information in the PLUGINS table, see The MySQL Plugin API.
Plugin information is also available from the `SHOW PLUGINS` statement. See `SHOW PLUGINS Statement`. These statements are equivalent:

```
SELECT
  PLUGIN_NAME, PLUGIN_STATUS, PLUGIN_TYPE,
  PLUGIN_LIBRARY, PLUGIN_LICENSE
FROM INFORMATION_SCHEMA.PLUGINS;
SHOW PLUGINS;
```
Chapter 21 The INFORMATION_SCHEMA PROCESSLIST Table

The MySQL process list indicates the operations currently being performed by the set of threads executing within the server. The `PROCESSLIST` table is one source of process information. For a comparison of this table with other sources, see Sources of Process Information.

The `PROCESSLIST` table has these columns:

- **ID**
  The connection identifier. This is the same value displayed in the `Id` column of the `SHOW PROCESSLIST` statement, displayed in the `PROCESSLIST_ID` column of the Performance Schema `threads` table, and returned by the `CONNECTION_ID()` function within the thread.

- **USER**
  The MySQL user who issued the statement. A value of `system user` refers to a nonclient thread spawned by the server to handle tasks internally, for example, a delayed-row handler thread or an I/O or SQL thread used on replica hosts. For `system user`, there is no host specified in the `Host` column. `unauthenticated user` refers to a thread that has become associated with a client connection but for which authentication of the client user has not yet occurred. `event_scheduler` refers to the thread that monitors scheduled events (see Using the Event Scheduler).

  **Note**
  A `USER` value of `system user` is distinct from the `SYSTEM_USER` privilege. The former designates internal threads. The latter distinguishes the system user and regular user account categories (see Account Categories).

- **HOST**
  The host name of the client issuing the statement (except for `system user`, for which there is no host). The host name for TCP/IP connections is reported in `host_name:client_port` format to make it easier to determine which client is doing what.

- **DB**
  The default database for the thread, or `NULL` if none has been selected.

- **COMMAND**
  The type of command the thread is executing on behalf of the client, or `Sleep` if the session is idle. For descriptions of thread commands, see Examining Server Thread (Process) Information. The value of this column corresponds to the `COM_xxx` commands of the client/server protocol and `Com_xxx` status variables. See Server Status Variables.

- **TIME**
  The time in seconds that the thread has been in its current state. For a replica SQL thread, the value is the number of seconds between the timestamp of the last replicated event and the real time of the replica host. See Replication Threads.

- **STATE**
  An action, event, or state that indicates what the thread is doing. For descriptions of `STATE` values, see Examining Server Thread (Process) Information.

Most states correspond to very quick operations. If a thread stays in a given state for many seconds, there might be a problem that needs to be investigated.
• **INFO**

The statement the thread is executing, or NULL if it is executing no statement. The statement might be the one sent to the server, or an innermost statement if the statement executes other statements. For example, if a CALL statement executes a stored procedure that is executing a SELECT statement, the INFO value shows the SELECT statement.

## Notes

• **PROCESSLIST** is a nonstandard INFORMATION_SCHEMA table.

• Like the output from the SHOW PROCESSLIST statement, the PROCESSLIST table provides information about all threads, even those belonging to other users, if you have the PROCESS privilege. Otherwise (without the PROCESS privilege), nonanonymous users have access to information about their own threads but not threads for other users, and anonymous users have no access to thread information.

• If an SQL statement refers to the PROCESSLIST table, MySQL populates the entire table once, when statement execution begins, so there is read consistency during the statement. There is no read consistency for a multi-statement transaction.

The following statements are equivalent:

```
SELECT * FROM INFORMATION_SCHEMA.PROCESSLIST
SHOW FULL PROCESSLIST
```
Chapter 22 The INFORMATION_SCHEMA PROFILING Table

The `PROFILING` table provides statement profiling information. Its contents correspond to the information produced by the `SHOW PROFILE` and `SHOW PROFILES` statements (see `SHOW PROFILE Statement`). The table is empty unless the `profiling` session variable is set to 1.

Note

This table is deprecated and will be removed in a future MySQL release. Use the Performance Schema instead; see Query Profiling Using Performance Schema.

The `PROFILING` table has these columns:

- **QUERY_ID**
  A numeric statement identifier.

- **SEQ**
  A sequence number indicating the display order for rows with the same `QUERY_ID` value.

- **STATE**
  The profiling state to which the row measurements apply.

- **DURATION**
  How long statement execution remained in the given state, in seconds.

- **CPU_USER, CPU_SYSTEM**
  User and system CPU use, in seconds.

- **CONTEXT_VOLUNTARY, CONTEXT_INVOLUNTARY**
  How many voluntary and involuntary context switches occurred.

- **BLOCK_OPS_IN, BLOCK_OPS_OUT**
  The number of block input and output operations.

- **MESSAGES_SENT, MESSAGES_RECEIVED**
  The number of communication messages sent and received.

- **PAGE_FAULTS_MAJOR, PAGE_FAULTS_MINOR**
  The number of major and minor page faults.

- **SWAPS**
  How many swaps occurred.

- **SOURCE_FUNCTION, SOURCE_FILE, and SOURCE_LINE**
  Information indicating where in the source code the profiled state executes.

Notes

- **PROFILING** is a nonstandard INFORMATION_SCHEMA table.

Profiling information is also available from the `SHOW PROFILE` and `SHOW PROFILES` statements. See `SHOW PROFILE Statement`. For example, the following queries are equivalent:
SHOW PROFILE FOR QUERY 2;
SELECT STATE, FORMAT(DURATION, 6) AS DURATION
FROM INFORMATION_SCHEMA.PROFILING
WHERE QUERY_ID = 2 ORDER BY SEQ;
Chapter 23 The INFORMATION_SCHEMA
REFERENTIAL_CONSTRAINTS Table

The REFERENTIAL_CONSTRAINTS table provides information about foreign keys. The REFERENTIAL_CONSTRAINTS table has these columns:

- CONSTRAINT_CATALOG
  The name of the catalog to which the constraint belongs. This value is always def.

- CONSTRAINT_SCHEMA
  The name of the schema (database) to which the constraint belongs.

- CONSTRAINT_NAME
  The name of the constraint.

- UNIQUE_CONSTRAINT_CATALOG
  The name of the catalog containing the unique constraint that the constraint references. This value is always def.

- UNIQUE_CONSTRAINT_SCHEMA
  The name of the schema containing the unique constraint that the constraint references.

- UNIQUE_CONSTRAINT_NAME
  The name of the unique constraint that the constraint references.

- MATCH_OPTION
  The value of the constraint MATCH attribute. The only valid value at this time is NONE.

- UPDATE_RULE
  The value of the constraint ON UPDATE attribute. The possible values are CASCADE, SET NULL, SET DEFAULT, RESTRICT, NO ACTION.

- DELETE_RULE
  The value of the constraint ON DELETE attribute. The possible values are CASCADE, SET NULL, SET DEFAULT, RESTRICT, NO ACTION.

- TABLE_NAME
  The name of the table. This value is the same as in the TABLE_CONSTRAINTS table.

- REFERENCED_TABLE_NAME
  The name of the table referenced by the constraint.
Chapter 24 The INFORMATION_SCHEMA RESOURCE_GROUPS Table

The RESOURCE_GROUPS table provides access to information about resource groups. For general discussion of the resource group capability, see Resource Groups.

You can see information only for columns for which you have some privilege.

The RESOURCE_GROUPS table has these columns:

- RESOURCE_GROUP_NAME
  The name of the resource group.

- RESOURCE_GROUP_TYPE
  The resource group type, either SYSTEM or USER.

- RESOURCE_GROUP_ENABLED
  Whether the resource group is enabled (1) or disabled (0);

- VCPU_IDS
  The CPU affinity; that is, the set of virtual CPUs that the resource group can use. The value is a list of comma-separated CPU numbers or ranges.

- THREAD_PRIORITY
  The priority for threads assigned to the resource group. The priority ranges from -20 (highest priority) to 19 (lowest priority). System resource groups have a priority that ranges from -20 to 0. User resource groups have a priority that ranges from 0 to 19.
The `ROLE_COLUMN_GRANTS` table (available as of MySQL 8.0.19) provides information about the column privileges for roles that are available to or granted by the currently enabled roles.

The `ROLE_COLUMN_GRANTS` table has these columns:

- **GRANTOR**
  The user name part of the account that granted the role.

- **GRANTOR_HOST**
  The host name part of the account that granted the role.

- **GRANTEE**
  The user name part of the account to which the role is granted.

- **GRANTEE_HOST**
  The host name part of the account to which the role is granted.

- **TABLE_CATALOG**
  The name of the catalog to which the role applies. This value is always `def`.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the role applies.

- **TABLE_NAME**
  The name of the table to which the role applies.

- **COLUMN_NAME**
  The name of the column to which the role applies.

- **PRIVILEGE_TYPE**
  The privilege granted. The value can be any privilege that can be granted at the column level; see `GRANT Statement`. Each row lists a single privilege, so there is one row per column privilege held by the grantee.

- **IS_GRANTABLE**
  `YES` or `NO`, depending on whether the role is grantable to other accounts.
The `ROLE_ROUTINE_GRANTS` table (available as of MySQL 8.0.19) provides information about the routine privileges for roles that are available to or granted by the currently enabled roles.

The `ROLE_ROUTINE_GRANTS` table has these columns:

- **GRANTOR**
  The user name part of the account that granted the role.

- **GRANTOR_HOST**
  The host name part of the account that granted the role.

- **GRANTEE**
  The user name part of the account to which the role is granted.

- **GRANTEE_HOST**
  The host name part of the account to which the role is granted.

- **SPECIFIC_CATALOG**
  The name of the catalog to which the routine belongs. This value is always `def`.

- **SPECIFIC_SCHEMA**
  The name of the schema (database) to which the routine belongs.

- **SPECIFIC_NAME**
  The name of the routine.

- **ROUTINE_CATALOG**
  The name of the catalog to which the routine belongs. This value is always `def`.

- **ROUTINE_SCHEMA**
  The name of the schema (database) to which the routine belongs.

- **ROUTINE_NAME**
  The name of the routine.

- **PRIVILEGE_TYPE**
  The privilege granted. The value can be any privilege that can be granted at the routine level; see `GRANT Statement`. Each row lists a single privilege, so there is one row per column privilege held by the grantee.

- **IS_GRANTABLE**
  `YES` or `NO`, depending on whether the role is grantable to other accounts.
Chapter 27 The INFORMATION_SCHEMA
ROLE_TABLE_GRANTS Table

The ROLE_TABLE_GRANTS table (available as of MySQL 8.0.19) provides information about the table privileges for roles that are available to or granted by the currently enabled roles.

The ROLE_TABLE_GRANTS table has these columns:

- **GRANTOR**
  The user name part of the account that granted the role.

- **GRANTOR_HOST**
  The host name part of the account that granted the role.

- **GRANTEE**
  The user name part of the account to which the role is granted.

- **GRANTEE_HOST**
  The host name part of the account to which the role is granted.

- **TABLE_CATALOG**
  The name of the catalog to which the role applies. This value is always `def`.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the role applies.

- **TABLE_NAME**
  The name of the table to which the role applies.

- **PRIVILEGE_TYPE**
  The privilege granted. The value can be any privilege that can be granted at the table level; see GRANT Statement. Each row lists a single privilege, so there is one row per column privilege held by the grantee.

- **IS_GRANTABLE**
  YES or NO, depending on whether the role is grantable to other accounts.
Chapter 28 The INFORMATION_SCHEMA ROUTINES Table

The ROUTINES table provides information about stored routines (stored procedures and stored functions). The ROUTINES table does not include built-in SQL functions or user-defined functions (UDFs).

The ROUTINES table has these columns:

- **SPECIFIC_NAME**
  The name of the routine.

- **ROUTINE_CATALOG**
  The name of the catalog to which the routine belongs. This value is always def.

- **ROUTINE_SCHEMA**
  The name of the schema (database) to which the routine belongs.

- **ROUTINE_NAME**
  The name of the routine.

- **ROUTINE_TYPE**
  PROCEDURE for stored procedures, FUNCTION for stored functions.

- **DATA_TYPE**
  If the routine is a stored function, the return value data type. If the routine is a stored procedure, this value is empty.

  The DATA_TYPE value is the type name only with no other information. The DTD_IDENTIFIER value contains the type name and possibly other information such as the precision or length.

- **CHARACTER_MAXIMUM_LENGTH**
  For stored function string return values, the maximum length in characters. If the routine is a stored procedure, this value is NULL.

- **CHARACTER_OCTET_LENGTH**
  For stored function string return values, the maximum length in bytes. If the routine is a stored procedure, this value is NULL.

- **NUMERIC_PRECISION**
  For stored function numeric return values, the numeric precision. If the routine is a stored procedure, this value is NULL.

- **NUMERIC_SCALE**
  For stored function numeric return values, the numeric scale. If the routine is a stored procedure, this value is NULL.

- **DATETIME_PRECISION**
  For stored function temporal return values, the fractional seconds precision. If the routine is a stored procedure, this value is NULL.

- **CHARACTER_SET_NAME**
For stored function character string return values, the character set name. If the routine is a stored procedure, this value is **NULL**.

- **COLLATION_NAME**
  
  For stored function character string return values, the collation name. If the routine is a stored procedure, this value is **NULL**.

- **DTD_IDENTIFIER**
  
  If the routine is a stored function, the return value data type. If the routine is a stored procedure, this value is empty.

  The **DATA_TYPE** value is the type name only with no other information. The **DTD_IDENTIFIER** value contains the type name and possibly other information such as the precision or length.

- **ROUTINE_BODY**
  
  The language used for the routine definition. This value is always **SQL**.

- **ROUTINE_DEFINITION**
  
  The text of the SQL statement executed by the routine.

- **EXTERNAL_NAME**
  
  This value is always **NULL**.

- **EXTERNAL_LANGUAGE**
  
  The language of the stored routine. The value is read from the `external_language` column of the `mysql.routines` data dictionary table.

- **PARAMETERSTYLE**
  
  This value is always **SQL**.

- **IS_DETERMINISTIC**
  
  **YES** or **NO**, depending on whether the routine is defined with the **DETERMINISTIC** characteristic.

- **SQL_DATA_ACCESS**
  
  The data access characteristic for the routine. The value is one of **CONTAINS SQL**, **NO SQL**, **READS SQL DATA**, or **MODIFIES SQL DATA**.

- **SQL_PATH**
  
  This value is always **NULL**.

- **SECURITY_TYPE**
  
  The routine **SQL SECURITY** characteristic. The value is one of **DEFINER** or **INVOKER**.

- **CREATED**
  
  The date and time when the routine was created. This is a **TIMESTAMP** value.

- **LAST_ALTERED**
  
  The date and time when the routine was last modified. This is a **TIMESTAMP** value. If the routine has not been modified since its creation, this value is the same as the **CREATED** value.
Notes

- **SQL_MODE**
  The SQL mode in effect when the routine was created or altered, and under which the routine executes. For the permitted values, see Server SQL Modes.

- **ROUTINE_COMMENT**
  The text of the comment, if the routine has one. If not, this value is empty.

- **DEFINER**
  The account named in the **DEFINER** clause (often the user who created the routine), in `'user_name'@'host_name'` format.

- **CHARACTER_SET_CLIENT**
  The session value of the `character_set_client` system variable when the routine was created.

- **COLLATION_CONNECTION**
  The session value of the `collation_connection` system variable when the routine was created.

- **DATABASE_COLLATION**
  The collation of the database with which the routine is associated.

Notes

- To see information about a routine, you must be the user named as the routine **DEFINER**, have the **SHOW_ROUTINE** privilege, have the **SELECT** privilege at the global level, or have the **CREATE ROUTINE**, **ALTER ROUTINE**, or **EXECUTE** privilege granted at a scope that includes the routine. The **ROUTINE_DEFINITION** column is NULL if you have only **CREATE ROUTINE**, **ALTER ROUTINE**, or **EXECUTE**.

- Information about stored function return values is also available in the **PARAMETERS** table. The return value row for a stored function can be identified as the row that has an **ORDINAL_POSITION** value of 0.
Chapter 29 The INFORMATION_SCHEMA SCHEMATA Table

A schema is a database, so the SCHEMA table provides information about databases.

The SCHEMA table has these columns:

- **CATALOG_NAME**
  
  The name of the catalog to which the schema belongs. This value is always def.

- **SCHEMA_NAME**
  
  The name of the schema.

- **DEFAULT_CHARACTER_SET_NAME**
  
  The schema default character set.

- **DEFAULT_COLLATION_NAME**
  
  The schema default collation.

- **SQL_PATH**
  
  This value is always NULL.

- **DEFAULT_ENCRYPTION**
  
  The schema default encryption. This column was added in MySQL 8.0.16.

Schema names are also available from the SHOW DATABASES statement. See SHOW DATABASES Statement. The following statements are equivalent:

```sql
SELECT SCHEMA_NAME AS 'Database'
FROM INFORMATION_SCHEMA.SCHEMATA
[WHERE SCHEMA_NAME LIKE 'wild']
SHOW DATABASES
[LIKE 'wild']
```

You see only those databases for which you have some kind of privilege, unless you have the global SHOW DATABASES privilege.

**Caution**

Because any static global privilege is considered a privilege for all databases, any static global privilege enables a user to see all database names with SHOW DATABASES or by examining the SCHEMA table of INFORMATION_SCHEMA, except databases that have been restricted at the database level by partial revokes.

**Notes**

- The SCHEMA_EXTENSIONS table augments the SCHEMA table with information about schema options.
Chapter 30 The INFORMATION_SCHEMA SCHEMATA_EXTENSIONS Table

The SCHEMATA_EXTENSIONS table (available as of MySQL 8.0.22) augments the SCHEMATA table with information about schema options.

The SCHEMATA_EXTENSIONS table has these columns:

- **CATALOG_NAME**
  The name of the catalog to which the schema belongs. This value is always def.

- **SCHEMA_NAME**
  The name of the schema.

- **OPTIONS**
  The options for the schema. If the schema is read only, the value contains READ ONLY=1. If the schema is not read only, no READ ONLY option appears.

**Example**

```sql
mysql> ALTER SCHEMA mydb READ ONLY = 1;
mysql> SELECT * FROM INFORMATION_SCHEMA.SCHEMATA_EXTENSIONS
    WHERE SCHEMA_NAME = 'mydb';
+--------------+-------------+-------------+
<table>
<thead>
<tr>
<th>CATALOG_NAME</th>
<th>SCHEMA_NAME</th>
<th>OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>def</td>
<td>mydb</td>
<td>READ ONLY=1</td>
</tr>
</tbody>
</table>
+--------------+-------------+-------------+
mysql> ALTER SCHEMA mydb READ ONLY = 0;
mysql> SELECT * FROM INFORMATION_SCHEMA.SCHEMATA_EXTENSIONS
    WHERE SCHEMA_NAME = 'mydb';
+--------------+-------------+---------+
<table>
<thead>
<tr>
<th>CATALOG_NAME</th>
<th>SCHEMA_NAME</th>
<th>OPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>def</td>
<td>mydb</td>
<td></td>
</tr>
</tbody>
</table>
+--------------+-------------+---------+
```

**Notes**

- SCHEMATA_EXTENSIONS is a nonstandard INFORMATION_SCHEMA table.
The SCHEMA_PRIVILEGES table provides information about schema (database) privileges. It takes its values from the mysql.db system table.

The SCHEMA_PRIVILEGES table has these columns:

- **GRANTEE**
  The name of the account to which the privilege is granted, in 'user_name'@'host_name' format.

- **TABLE_CATALOG**
  The name of the catalog to which the schema belongs. This value is always def.

- **TABLE_SCHEMA**
  The name of the schema.

- **PRIVILEGE_TYPE**
  The privilege granted. The value can be any privilege that can be granted at the schema level; see GRANT Statement. Each row lists a single privilege, so there is one row per schema privilege held by the grantee.

- **IS_GRANTABLE**
  YES if the user has the GRANT OPTION privilege, NO otherwise. The output does not list GRANT OPTION as a separate row with PRIVILEGE_TYPE='GRANT OPTION'.

Notes

- **SCHEMA_PRIVILEGES** is a nonstandard INFORMATION_SCHEMA table.

The following statements are not equivalent:

```sql
SELECT ... FROM INFORMATION_SCHEMA.SCHEMA_PRIVILEGES
SHOW GRANTS ...```
Chapter 32 The INFORMATION_SCHEMA STATISTICS Table

The **STATISTICS** table provides information about table indexes.

Columns in **STATISTICS** that represent table statistics hold cached values. The `information_schema_stats_expiry` system variable defines the period of time before cached table statistics expire. The default is 86400 seconds (24 hours). If there are no cached statistics or statistics have expired, statistics are retrieved from storage engines when querying table statistics columns. To update cached values at any time for a given table, use **ANALYZE TABLE**. To always retrieve the latest statistics directly from storage engines, set `information_schema_stats_expiry=0`. For more information, see Optimizing INFORMATION_SCHEMA Queries.

**Note**

If the `innodb_read_only` system variable is enabled, **ANALYZE TABLE** may fail because it cannot update statistics tables in the data dictionary, which use InnoDB. For **ANALYZE TABLE** operations that update the key distribution, failure may occur even if the operation updates the table itself (for example, if it is a MyISAM table). To obtain the updated distribution statistics, set `information_schema_stats_expiry=0`.

The **STATISTICS** table has these columns:

- **TABLE_CATALOG**
  The name of the catalog to which the table containing the index belongs. This value is always `def`.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table containing the index belongs.

- **TABLE_NAME**
  The name of the table containing the index.

- **NON_UNIQUE**
  0 if the index cannot contain duplicates, 1 if it can.

- **INDEX_SCHEMA**
  The name of the schema (database) to which the index belongs.

- **INDEX_NAME**
  The name of the index. If the index is the primary key, the name is always `PRIMARY`.

- **SEQ_IN_INDEX**
  The column sequence number in the index, starting with 1.

- **COLUMN_NAME**
  The column name. See also the description for the **EXPRESSION** column.

- **COLLATION**
  How the column is sorted in the index. This can have values `A` (ascending), `D` (descending), or `NULL` (not sorted).

- **CARDINALITY**
An estimate of the number of unique values in the index. To update this number, run `ANALYZE TABLE` or (for `MyISAM` tables) `myisamchk -a`.

`CARDINALITY` is counted based on statistics stored as integers, so the value is not necessarily exact even for small tables. The higher the cardinality, the greater the chance that MySQL uses the index when doing joins.

- **SUB_PART**

  The index prefix. That is, the number of indexed characters if the column is only partly indexed, `NULL` if the entire column is indexed.

  **Note**

  Prefix *limits* are measured in bytes. However, prefix *lengths* for index specifications in `CREATE TABLE`, `ALTER TABLE`, and `CREATE INDEX` statements are interpreted as number of characters for nonbinary string types (`CHAR`, `VARCHAR`, `TEXT`) and number of bytes for binary string types (`BINARY`, `VARBINARY`, `BLOB`). Take this into account when specifying a prefix length for a nonbinary string column that uses a multibyte character set.

  For additional information about index prefixes, see Column Indexes, and CREATE INDEX Statement.

- **PACKED**

  Indicates how the key is packed. `NULL` if it is not.

- **NULLABLE**

  Contains `YES` if the column may contain `NULL` values and `' ' if not.

- **INDEX_TYPE**

  The index method used (`BLOOM`, `FULLTEXT`, `HASH`, `RTREE`).

- **COMMENT**

  Information about the index not described in its own column, such as `disabled` if the index is disabled.

- **INDEX_COMMENT**

  Any comment provided for the index with a `COMMENT` attribute when the index was created.

- **IS_VISIBLE**

  Whether the index is visible to the optimizer. See Invisible Indexes.

- **EXPRESSION**

  MySQL 8.0.13 and higher supports functional key parts (see Functional Key Parts), which affects both the `COLUMN_NAME` and `EXPRESSION` columns:

  - For a nonfunctional key part, `COLUMN_NAME` indicates the column indexed by the key part and `EXPRESSION` is `NULL`.

  - For a functional key part, `COLUMN_NAME` column is `NULL` and `EXPRESSION` indicates the expression for the key part.
Notes

- There is no standard INFORMATION_SCHEMA table for indexes. The MySQL column list is similar to what SQL Server 2000 returns for sp_statistics, except that QUALIFIER and OWNER are replaced with CATALOG and SCHEMA, respectively.

Information about table indexes is also available from the SHOW INDEX statement. See SHOW INDEX Statement. The following statements are equivalent:

```sql
SELECT * FROM INFORMATION_SCHEMA.STATISTICS
  WHERE table_name = 'tbl_name'
  AND table_schema = 'db_name'
SHOW INDEX
FROM tbl_name
FROM db_name
```
Chapter 33 The INFORMATION_SCHEMA
ST_GEOMETRY_COLUMNS Table

The ST_GEOMETRY_COLUMNS table provides information about table columns that store spatial data. This table is based on the SQL/MM (ISO/IEC 13249-3) standard, with extensions as noted. MySQL implements ST_GEOMETRY_COLUMNS as a view on the INFORMATION_SCHEMA COLUMNS table.

The ST_GEOMETRY_COLUMNS table has these columns:

- **TABLE_CATALOG**
  The name of the catalog to which the table containing the column belongs. This value is always def.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table containing the column belongs.

- **TABLE_NAME**
  The name of the table containing the column.

- **COLUMN_NAME**
  The name of the column.

- **SRS_NAME**
  The spatial reference system (SRS) name.

- **SRS_ID**
  The spatial reference system ID (SRID).

- **GEOMETRY_TYPE_NAME**
  The column data type. Permitted values are: geometry, point, linestring, polygon, multipoint, multilinestring, multipolygon, geometrycollection. This column is a MySQL extension to the standard.
The `ST_SPATIAL_REFERENCE_SYSTEMS` table provides information about available spatial reference systems (SRSs) for spatial data. This table is based on the SQL/MM (ISO/IEC 13249-3) standard.

Entries in the `ST_SPATIAL_REFERENCE_SYSTEMS` table are based on the European Petroleum Survey Group (EPSG) data set, except for SRID 0, which corresponds to a special SRS used in MySQL that represents an infinite flat Cartesian plane with no units assigned to its axes. For additional information about SRSs, see Spatial Reference System Support.

The `ST_SPATIAL_REFERENCE_SYSTEMS` table has these columns:

- **SRS_NAME**
  The spatial reference system name. This value is unique.

- **SRS_ID**
  The spatial reference system numeric ID. This value is unique.
  
  SRS_ID values represent the same kind of values as the SRID of geometry values or passed as the SRID argument to spatial functions. SRID 0 (the unitless Cartesian plane) is special. It is always a legal spatial reference system ID and can be used in any computations on spatial data that depend on SRID values.

- **ORGANIZATION**
  The name of the organization that defined the coordinate system on which the spatial reference system is based.

- **ORGANIZATION_COORDSYS_ID**
  The numeric ID given to the spatial reference system by the organization that defined it.

- **DEFINITION**
  The spatial reference system definition. DEFINITION values are WKT values, represented as specified in the Open Geospatial Consortium document OGC 12-063r5.

  SRS definition parsing occurs on demand when definitions are needed by GIS functions. Parsed definitions are stored in the data dictionary cache to enable reuse and avoid incurring parsing overhead for every statement that needs SRS information.

- **DESCRIPTION**
  The spatial reference system description.

**Notes**

- The SRS_NAME, ORGANIZATION, ORGANIZATION_COORDSYS_ID, and DESCRIPTION columns contain information that may be of interest to users, but they are not used by MySQL.

**Example**

```sql
mysql> SELECT * FROM ST_SPATIAL_REFERENCE_SYSTEMS
WHERE SRS_ID = 4326;

+------------------+
| SRS_NAME | SRS_ID  | ORGANIZATION | DESCRIPTION         |
+------------------+
| WGS 84         | 4326   | EPSG         |                     |
+------------------+
```

83
This entry describes the SRS used for GPS systems. It has a name (SRS_NAME) of WGS 84 and an ID (SRS_ID) of 4326, which is the ID used by the European Petroleum Survey Group (EPSG).

The DEFINITION values for projected and geographic SRSs begin with PROJCS and GEOGCS, respectively. The definition for SRID 0 is special and has an empty DEFINITION value. The following query determines how many entries in the ST_SPATIAL_REFERENCE_SYSTEMS table correspond to projected, geographic, and other SRSs, based on DEFINITION values:

```
SELECT COUNT(*),
CASE LEFT(DEFINITION, 6)
WHEN 'PROJCS' THEN 'Projected'
WHEN 'GEOGCS' THEN 'Geographic'
ELSE 'Other'
END AS SRS_TYPE
FROM INFORMATION_SCHEMA.ST_SPATIAL_REFERENCE_SYSTEMS
GROUP BY SRS_TYPE;
```

<table>
<thead>
<tr>
<th>COUNT(*)</th>
<th>SRS_TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Other</td>
</tr>
<tr>
<td>4668</td>
<td>Projected</td>
</tr>
<tr>
<td>483</td>
<td>Geographic</td>
</tr>
</tbody>
</table>

To enable manipulation of SRS entries stored in the data dictionary, MySQL provides these SQL statements:

- **CREATE SPATIAL REFERENCE SYSTEM**: See CREATE SPATIAL REFERENCE SYSTEM Statement. The description for this statement includes additional information about SRS components.

- **DROP SPATIAL REFERENCE SYSTEM**: See DROP SPATIAL REFERENCE SYSTEM Statement.
Chapter 35 The INFORMATION_SCHEMA
ST_UNITS_OF_MEASURE Table

The ST_UNITS_OF_MEASURE table (available as of MySQL 8.0.14) provides information about acceptable units for the ST_Distance() function.

The ST_UNITS_OF_MEASURE table has these columns:

- **UNIT_NAME**
  The name of the unit.

- **UNIT_TYPE**
  The unit type (for example, LINEAR).

- **CONVERSION_FACTOR**
  A conversion factor used for internal calculations.

- **DESCRIPTION**
  A description of the unit.
Chapter 36 The INFORMATION_SCHEMA TABLES Table

The TABLES table provides information about tables in databases.

Columns in TABLES that represent table statistics hold cached values. The
information_schema_stats_expiry system variable defines the period of time before cached
table statistics expire. The default is 86400 seconds (24 hours). If there are no cached statistics or
statistics have expired, statistics are retrieved from storage engines when querying table statistics
columns. To update cached values at any time for a given table, use ANALYZE TABLE. To always
retrieve the latest statistics directly from storage engines, set information_schema_stats_expiry
to 0. For more information, see Optimizing INFORMATION_SCHEMA Queries.

Note

If the innodb_read_only system variable is enabled, ANALYZE TABLE
may fail because it cannot update statistics tables in the data dictionary,
which use InnoDB. For ANALYZE TABLE operations that update the key
distribution, failure may occur even if the operation updates the table itself (for
example, if it is a MyISAM table). To obtain the updated distribution statistics, set
information_schema_stats_expiry=0.

The TABLES table has these columns:

- **TABLE_CATALOG**
  The name of the catalog to which the table belongs. This value is always def.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table belongs.

- **TABLE_NAME**
  The name of the table.

- **TABLE_TYPE**
  BASE TABLE for a table, VIEW for a view, or SYSTEM VIEW for an INFORMATION_SCHEMA table.

- **ENGINE**
  The storage engine for the table. See The InnoDB Storage Engine, and Alternative Storage Engines.
  For partitioned tables, ENGINE shows the name of the storage engine used by all partitions.

- **VERSION**
  This column is unused. With the removal of .frm files in MySQL 8.0, this column now reports a
  hardcoded value of 10, which is the last .frm file version used in MySQL 5.7.

- **ROW_FORMAT**
  The row-storage format (Fixed, Dynamic, Compressed, Redundant, Compact). For MyISAM
tables, Dynamic corresponds to what myisamchk -dvv reports as Packed.

- **TABLE_ROWS**
  The number of rows. Some storage engines, such as MyISAM, store the exact count. For other
  storage engines, such as InnoDB, this value is an approximation, and may vary from the actual
  value by as much as 40% to 50%. In such cases, use SELECT COUNT(*) to obtain an accurate count.
**TABLE_ROWS** is **NULL** for **INFORMATION_SCHEMA** tables.

For InnoDB tables, the row count is only a rough estimate used in SQL optimization. (This is also true if the InnoDB table is partitioned.)

- **AVG_ROW_LENGTH**

  The average row length.

- **DATA_LENGTH**

  For MyISAM, **DATA_LENGTH** is the length of the data file, in bytes.

  For InnoDB, **DATA_LENGTH** is the approximate amount of space allocated for the clustered index, in bytes. Specifically, it is the clustered index size, in pages, multiplied by the InnoDB page size.

Refer to the notes at the end of this section for information regarding other storage engines.

- **MAX_DATA_LENGTH**

  For MyISAM, **MAX_DATA_LENGTH** is maximum length of the data file. This is the total number of bytes of data that can be stored in the table, given the data pointer size used.

  Unused for InnoDB.

  Refer to the notes at the end of this section for information regarding other storage engines.

- **INDEX_LENGTH**

  For MyISAM, **INDEX_LENGTH** is the length of the index file, in bytes.

  For InnoDB, **INDEX_LENGTH** is the approximate amount of space allocated for non-clustered indexes, in bytes. Specifically, it is the sum of non-clustered index sizes, in pages, multiplied by the InnoDB page size.

  Refer to the notes at the end of this section for information regarding other storage engines.

- **DATA_FREE**

  The number of allocated but unused bytes.

  InnoDB tables report the free space of the tablespace to which the table belongs. For a table located in the shared tablespace, this is the free space of the shared tablespace. If you are using multiple tablespaces and the table has its own tablespace, the free space is for only that table. Free space means the number of bytes in completely free extents minus a safety margin. Even if free space displays as 0, it may be possible to insert rows as long as new extents need not be allocated.

  For NDB Cluster, **DATA_FREE** shows the space allocated on disk for, but not used by, a Disk Data table or fragment on disk. (In-memory data resource usage is reported by the **DATA_LENGTH** column.)

  For partitioned tables, this value is only an estimate and may not be absolutely correct. A more accurate method of obtaining this information in such cases is to query the **INFORMATION_SCHEMA PARTITIONS** table, as shown in this example:

```sql
SELECT SUM(DATA_FREE)
FROM INFORMATION_SCHEMA.PARTITIONS
WHERE TABLE_SCHEMA = 'mydb'
AND   TABLE_NAME   = 'mytable';
```

For more information, see Chapter 19, *The INFORMATION_SCHEMA PARTITIONS Table*. 

88
• **AUTO_INCREMENT**

The next **AUTO_INCREMENT** value.

• **CREATE_TIME**

When the table was created.

• **UPDATE_TIME**

When the data file was last updated. For some storage engines, this value is **NULL**. For example, InnoDB stores multiple tables in its **system tablespace** and the data file timestamp does not apply. Even with file-per-table mode with each InnoDB table in a separate .ibd file, change buffering can delay the write to the data file, so the file modification time is different from the time of the last insert, update, or delete. For **MyISAM**, the data file timestamp is used; however, on Windows the timestamp is not updated by updates, so the value is inaccurate.

**UPDATE_TIME** displays a timestamp value for the last **UPDATE**, **INSERT**, or **DELETE** performed on InnoDB tables that are not partitioned. For MVCC, the timestamp value reflects the **COMMIT** time, which is considered the last update time. Timestamps are not persisted when the server is restarted or when the table is evicted from the InnoDB data dictionary cache.

• **CHECK_TIME**

When the table was last checked. Not all storage engines update this time, in which case, the value is always **NULL**.

For partitioned InnoDB tables, **CHECK_TIME** is always **NULL**.

• **TABLE_COLLATION**

The table default collation. The output does not explicitly list the table default character set, but the collation name begins with the character set name.

• **CHECKSUM**

The live checksum value, if any.

• **CREATE_OPTIONS**

Extra options used with **CREATE TABLE**.

**CREATE_OPTIONS** shows partitioned for a partitioned table.

Prior to MySQL 8.0.16, **CREATE_OPTIONS** shows the **ENCRYPTION** clause specified for tables created in file-per-table tablespaces. As of MySQL 8.0.16, it shows the encryption clause for file-per-table tablespaces if the table is encrypted or if the specified encryption differs from the schema encryption. The encryption clause is not shown for tables created in general tablespaces. To identify encrypted file-per-table and general tablespaces, query the **INNODB_TABLESPACES ENCRYPTION** column.

When creating a table with **strict mode** disabled, the storage engine's default row format is used if the specified row format is not supported. The actual row format of the table is reported in the **ROW_FORMAT** column. **CREATE_OPTIONS** shows the row format that was specified in the **CREATE TABLE** statement.

When altering the storage engine of a table, table options that are not applicable to the new storage engine are retained in the table definition to enable reverting the table with its previously defined options to the original storage engine, if necessary. The **CREATE_OPTIONS** column may show retained options.

• **TABLE_COMMENT**
Notes

The comment used when creating the table (or information as to why MySQL could not access the table information).

Notes

- For NDB tables, the output of this statement shows appropriate values for the \texttt{AVG\_ROW\_LENGTH} and \texttt{DATA\_LENGTH} columns, with the exception that \texttt{BLOB} columns are not taken into account.

- For NDB tables, \texttt{DATA\_LENGTH} includes data stored in main memory only; the \texttt{MAX\_DATA\_LENGTH} and \texttt{DATA\_FREE} columns apply to Disk Data.

- For NDB Cluster Disk Data tables, \texttt{MAX\_DATA\_LENGTH} shows the space allocated for the disk part of a Disk Data table or fragment. (In-memory data resource usage is reported by the \texttt{DATA\_LENGTH} column.)

- For MEMORY tables, the \texttt{DATA\_LENGTH}, \texttt{MAX\_DATA\_LENGTH}, and \texttt{INDEX\_LENGTH} values approximate the actual amount of allocated memory. The allocation algorithm reserves memory in large amounts to reduce the number of allocation operations.

- For views, most \texttt{TABLES} columns are \texttt{0} or \texttt{NULL} except that \texttt{TABLE\_NAME} indicates the view name, \texttt{CREATE\_TIME} indicates the creation time, and \texttt{TABLE\_COMMENT} says \texttt{VIEW}.

Table information is also available from the \texttt{SHOW\ TABLE\ STATUS} and \texttt{SHOW\ TABLES} statements. See \texttt{SHOW\ TABLE\ STATUS\ Statement}, and \texttt{SHOW\ TABLES\ Statement}. The following statements are equivalent:

\begin{verbatim}
SELECT TABLE\_NAME, ENGINE, VERSION, ROW\_FORMAT, TABLE\_ROWS, AVG\_ROW\_LENGTH, DATA\_LENGTH, MAX\_DATA\_LENGTH, INDEX\_LENGTH, DATA\_FREE, AUTO\_INCREMENT, CREATE\_TIME, UPDATE\_TIME, CHECK\_TIME, TABLE\_COLLATION, CHECKSUM, CREATE\_OPTIONS, TABLE\_COMMENT FROM INFORMATION\_SCHEMA\_TABLES WHERE table\_schema = 'db\_name' [AND table\_name LIKE 'wild']
SHOW TABLE STATUS FROM db\_name [LIKE 'wild']
\end{verbatim}

The following statements are equivalent:

\begin{verbatim}
SELECT TABLE\_NAME, TABLE\_TYPE FROM INFORMATION\_SCHEMA\_TABLES WHERE table\_schema = 'db\_name' [AND table\_name LIKE 'wild']
SHOW FULL TABLES FROM db\_name [LIKE 'wild']
\end{verbatim}
Chapter 37 The INFORMATION_SCHEMA TABLESPACES Table

This table is unused. It is deprecated and will be removed in a future MySQL release. Other INFORMATION_SCHEMA tables may provide related information:

- For NDB, the INFORMATION_SCHEMA FILES table provides tablespace-related information.
- For InnoDB, the INFORMATION_SCHEMA INNODB_TABLESPACES and INNODB_DATAFILES tables provide tablespace metadata.
The `TABLE_CONSTRAINTS` table describes which tables have constraints.

The `TABLE_CONSTRAINTS` table has these columns:

- **CONSTRAINT_CATALOG**
  The name of the catalog to which the constraint belongs. This value is always **def**.

- **CONSTRAINT_SCHEMA**
  The name of the schema (database) to which the constraint belongs.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table belongs.

- **TABLE_NAME**
  The name of the table.

- **CONSTRAINT_TYPE**
  The type of constraint. The value can be UNIQUE, PRIMARY KEY, FOREIGN KEY, or (as of MySQL 8.0.16) CHECK. This is a **CHAR** (not ENUM) column.

  The UNIQUE and PRIMARY KEY information is about the same as what you get from the **Key_name** column in the output from **SHOW INDEX** when the **Non_unique** column is 0.

- **ENFORCED**
  For CHECK constraints, the value is **YES** or **NO** to indicate whether the constraint is enforced. For other constraints, the value is always **YES**.

  This column was added in MySQL 8.0.16.
Chapter 39 The INFORMATION_SCHEMA TABLE_PRIVILEGES Table

The TABLE_PRIVILEGES table provides information about table privileges. It takes its values from the mysql.tables_priv system table.

The TABLE_PRIVILEGES table has these columns:

- **GRANTEE**
  The name of the account to which the privilege is granted, in 'user_name'@'host_name' format.

- **TABLE_CATALOG**
  The name of the catalog to which the table belongs. This value is always def.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table belongs.

- **TABLE_NAME**
  The name of the table.

- **PRIVILEGE_TYPE**
  The privilege granted. The value can be any privilege that can be granted at the table level; see GRANT Statement. Each row lists a single privilege, so there is one row per table privilege held by the grantee.

- **IS_GRANTABLE**
  YES if the user has the GRANT OPTION privilege, NO otherwise. The output does not list GRANT OPTION as a separate row with PRIVILEGE_TYPE='GRANT OPTION'.

Notes

- **TABLE_PRIVILEGES** is a nonstandard INFORMATION_SCHEMA table.

The following statements are not equivalent:

```sql
SELECT ... FROM INFORMATION_SCHEMA.TABLE_PRIVILEGES
SHOW GRANTS ...
```
Chapter 40 The INFORMATION_SCHEMA TRIGGERS Table

The TRIGGERS table provides information about triggers. To see information about a table's triggers, you must have the TRIGGER privilege for the table.

The TRIGGERS table has these columns:

- **TRIGGER_CATALOG**
  The name of the catalog to which the trigger belongs. This value is always def.

- **TRIGGER_SCHEMA**
  The name of the schema (database) to which the trigger belongs.

- **TRIGGER_NAME**
  The name of the trigger.

- **EVENT_MANIPULATION**
  The trigger event. This is the type of operation on the associated table for which the trigger activates. The value is INSERT (a row was inserted), DELETE (a row was deleted), or UPDATE (a row was modified).

- **EVENT_OBJECT_CATALOG**, **EVENT_OBJECT_SCHEMA**, and **EVENT_OBJECT_TABLE**
  As noted in Using Triggers, every trigger is associated with exactly one table. These columns indicate the catalog and schema (database) in which this table occurs, and the table name, respectively. The EVENT_OBJECT_CATALOG value is always def.

- **ACTION_ORDER**
  The ordinal position of the trigger's action within the list of triggers on the same table with the same EVENT_MANIPULATION and ACTION_TIMING values.

- **ACTION_CONDITION**
  This value is always NULL.

- **ACTION_STATEMENT**
  The trigger body; that is, the statement executed when the trigger activates. This text uses UTF-8 encoding.

- **ACTION_ORIENTATION**
  This value is always ROW.

- **ACTION_TIMING**
  Whether the trigger activates before or after the triggering event. The value is BEFORE or AFTER.

- **ACTION_REFERENCE_OLD_TABLE**
  This value is always NULL.

- **ACTION_REFERENCE_NEW_TABLE**
  This value is always NULL.

- **ACTION_REFERENCE_OLD_ROW** and **ACTION_REFERENCE_NEW_ROW**
The old and new column identifiers, respectively. The `ACTION_REFERENCE_OLD_ROW` value is always `OLD` and the `ACTION_REFERENCE_NEW_ROW` value is always `NEW`.

- **CREATED**
  
  The date and time when the trigger was created. This is a `TIMESTAMP(2)` value (with a fractional part in hundredths of seconds) for triggers.

- **SQL_MODE**

  The SQL mode in effect when the trigger was created, and under which the trigger executes. For the permitted values, see `Server SQL Modes`.

- **DEFINER**

  The account named in the `DEFINER` clause (often the user who created the trigger), in `'user_name'@'host_name'` format.

- **CHARACTER_SET_CLIENT**

  The session value of the `character_set_client` system variable when the trigger was created.

- **COLLATION_CONNECTION**

  The session value of the `collation_connection` system variable when the trigger was created.

- **DATABASE_COLLATION**

  The collation of the database with which the trigger is associated.

Example

The following example uses the `ins_sum` trigger defined in `Using Triggers`:

```sql
mysql> SELECT * FROM INFORMATION_SCHEMA.TRIGGERS
WHERE TRIGGER_SCHEMA='test' AND TRIGGER_NAME='ins_sum';
```

<table>
<thead>
<tr>
<th>TRIGGER_CATALOG</th>
<th>TRIGGER_SCHEMA</th>
<th>TRIGGER_NAME</th>
<th>EVENT_MANIPULATION</th>
<th>ACTION_ORIENTATION</th>
<th>ACTION_TIMING</th>
<th>ACTION_REFERENCE_OLD_TABLE</th>
<th>ACTION_REFERENCE_NEW_TABLE</th>
<th>ACTION_REFERENCE_OLD_ROW</th>
<th>ACTION_REFERENCE_NEW_ROW</th>
<th>CREATED</th>
<th>SQL_MODE</th>
<th>DEFINER</th>
<th>CHARACTER_SET_CLIENT</th>
<th>COLLATION_CONNECTION</th>
<th>DATABASE_COLLATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>def</td>
<td>test</td>
<td>ins_sum</td>
<td>INSERT</td>
<td>ROW</td>
<td>BEFORE</td>
<td>NULL</td>
<td>NULL</td>
<td>OLD</td>
<td>NEW</td>
<td>2018-08-08 10:10:12.61</td>
<td>ONLY_FULL_GROUP_BY, STRICT_TRANS_TABLES, NO_ZERO_IN_DATE, NO_ZERO_DATE, ERROR_FOR_DIVISION_BY_ZERO, NO_ENGINE_SUBSTITUTION</td>
<td>me@localhost</td>
<td>utf8mb4</td>
<td>utf8mb4_0900_ai_ci</td>
<td></td>
</tr>
</tbody>
</table>

Trigger information is also available from the `SHOW TRIGGERS` statement. See `SHOW TRIGGERS Statement`.
Chapter 41 The INFORMATION_SCHEMA
USER_ATTRIBUTES Table

The USER_ATTRIBUTES table (available as of MySQL 8.0.21) provides information about user comments and user attributes. It takes its values from the mysql.user system table.

The USER_ATTRIBUTES table has these columns:

- **USER**
  The user name portion of the account to which the ATTRIBUTE column value applies.

- **HOST**
  The host name portion of the account to which the ATTRIBUTE column value applies.

- **ATTRIBUTE**
  The user comment, user attribute, or both belonging to the account specified by the USER and HOST columns. The value is in JSON object notation. Attributes are shown exactly as set using a CREATE USER ... ATTRIBUTE ... or ALTER USER ... ATTRIBUTE ... statement. The user comment is shown as a key-value pair having comment as the key.

For example, the statement `CREATE USER 'bill'@'localhost' COMMENT 'A comment' ATTRIBUTE '{"foo": "bar", "bazz": "fazz"}'` adds the following row to the USER_ATTRIBUTES table:

```
<table>
<thead>
<tr>
<th>USER</th>
<th>HOST</th>
<th>ATTRIBUTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>bill</td>
<td>localhost</td>
<td>{&quot;foo&quot;: &quot;bar&quot;, &quot;bazz&quot;: &quot;fazz&quot;, &quot;comment&quot;: &quot;A comment&quot;}</td>
</tr>
</tbody>
</table>
```

**Notes**

- USER_ATTRIBUTES is a nonstandard INFORMATION_SCHEMA table.

- To obtain only the user comment for a given user as an unquoted string, you can employ a query such as this one:

```
mysql> SELECT ATTRIBUTE->>"$.comment" AS Comment
       -> FROM INFORMATION_SCHEMA.USER_ATTRIBUTES
       -> WHERE USER='bill' AND HOST='localhost';
```

```
<table>
<thead>
<tr>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>A comment</td>
</tr>
</tbody>
</table>
```

Similarly, you can obtain the unquoted value for a given user attribute using its key.

- Prior to MySQL 8.0.22, USER_ATTRIBUTES contents are accessible by anyone. As of MySQL 8.0.22, USER_ATTRIBUTES contents are accessible as follows:

  - All rows are accessible if:
    - The current thread is a replica thread.
    - The access control system has not been initialized (for example, the server was started with the --skip-grant-tables option).
    - The currently authenticated account has the UPDATE or SELECT privilege for the mysql.user system table.
• The currently authenticated account has the `CREATE_USER` and `SYSTEM_USER` privileges.

• Otherwise, the currently authenticated account can see the row for that account. Additionally, if the account has the `CREATE_USER` privilege but not the `SYSTEM_USER` privilege, it can see rows for all other accounts that do not have the `SYSTEM_USER` privilege.

For more information about specifying account comments and attributes, see `CREATE USER` Statement.
Chapter 42 The INFORMATION_SCHEMA
USER_PRIVILEGES Table

The USER_PRIVILEGES table provides information about global privileges. It takes its values from the mysql.user system table.

The USER_PRIVILEGES table has these columns:

- **GRANTEE**
  The name of the account to which the privilege is granted, in 'user_name'@'host_name' format.

- **TABLE_CATALOG**
  The name of the catalog. This value is always def.

- **PRIVILEGE_TYPE**
  The privilege granted. The value can be any privilege that can be granted at the global level; see GRANT Statement. Each row lists a single privilege, so there is one row per global privilege held by the grantee.

- **IS_GRANTABLE**
  YES if the user has the GRANT OPTION privilege, NO otherwise. The output does not list GRANT OPTION as a separate row with PRIVILEGE_TYPE='GRANT OPTION'.

Notes

- USER_PRIVILEGES is a nonstandard INFORMATION_SCHEMA table.

The following statements are not equivalent:

```sql
SELECT ... FROM INFORMATION_SCHEMA.USER_PRIVILEGES
SHOW GRANTS ...
```
Chapter 43 The INFORMATION_SCHEMA VIEWS Table

The VIEWS table provides information about views in databases. You must have the SHOW VIEW privilege to access this table.

The VIEWS table has these columns:

- **TABLE_CATALOG**
  The name of the catalog to which the view belongs. This value is always def.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the view belongs.

- **TABLE_NAME**
  The name of the view.

- **VIEW_DEFINITION**
  The SELECT statement that provides the definition of the view. This column has most of what you see in the Create Table column that SHOW CREATE VIEW produces. Skip the words before SELECT and skip the words WITH CHECK OPTION. Suppose that the original statement was:

  ```
  CREATE VIEW v AS
  SELECT s2, s1 FROM t
  WHERE s1 > 5
  ORDER BY s1
  WITH CHECK OPTION;
  ```

  Then the view definition looks like this:

  ```
  SELECT s2, s1 FROM t WHERE s1 > 5 ORDER BY s1
  ```

- **CHECK_OPTION**
  The value of the CHECK_OPTION attribute. The value is one of NONE, CASCADE, or LOCAL.

- **IS_UPDATABLE**
  MySQL sets a flag, called the view updatability flag, at CREATE VIEW time. The flag is set to YES (true) if UPDATE and DELETE (and similar operations) are legal for the view. Otherwise, the flag is set to NO (false). The IS_UPDATABLE column in the VIEWS table displays the status of this flag. It means that the server always knows whether a view is updatable.

  If a view is not updatable, statements such UPDATE, DELETE, and INSERT are illegal and are rejected. (Even if a view is updatable, it might not be possible to insert into it; for details, refer to Updatable and Insertable Views.)

- **DEFINER**
  The account of the user who created the view, in 'user_name'@'host_name' format.

- **SECURITY_TYPE**
  The view SQL SECURITY characteristic. The value is one of DEFINER or INVOKER.

- **CHARACTER_SET_CLIENT**
  The session value of the character_set_client system variable when the view was created.

- **COLLATION_CONNECTION**
Notes

The session value of the `collation_connection` system variable when the view was created.

Notes

MySQL permits different `sql_mode` settings to tell the server the type of SQL syntax to support. For example, you might use the ANSI SQL mode to ensure MySQL correctly interprets the standard SQL concatenation operator, the double bar (||), in your queries. If you then create a view that concatenates items, you might worry that changing the `sql_mode` setting to a value different from ANSI could cause the view to become invalid. But this is not the case. No matter how you write out a view definition, MySQL always stores it the same way, in a canonical form. Here is an example that shows how the server changes a double bar concatenation operator to a `CONCAT()` function:

```sql
mysql> SET sql_mode = 'ANSI';
Query OK, 0 rows affected (0.00 sec)
mysql> CREATE VIEW test.v AS SELECT 'a' || 'b' as col1;
Query OK, 0 rows affected (0.00 sec)
mysql> SELECT VIEW_DEFINITION FROM INFORMATION_SCHEMA.VIEWS
WHERE TABLE_SCHEMA = 'test' AND TABLE_NAME = 'v';
+----------------------------------+
| VIEW_DEFINITION                  |
+----------------------------------+
| select concat('a','b') AS 'col1' |
+----------------------------------+
1 row in set (0.00 sec)
```

The advantage of storing a view definition in canonical form is that changes made later to the value of `sql_mode` do not affect the results from the view. However, an additional consequence is that comments prior to `SELECT` are stripped from the definition by the server.
The `VIEW_ROUTINE_USAGE` table (available as of MySQL 8.0.13) provides access to information about stored functions used in view definitions. The table does not list information about built-in SQL functions or user-defined functions (UDFs) used in the definitions.

You can see information only for views for which you have some privilege, and only for functions for which you have some privilege.

The `VIEW_ROUTINE_USAGE` table has these columns:

- **TABLE_CATALOG**
  The name of the catalog to which the view belongs. This value is always **def**.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the view belongs.

- **TABLE_NAME**
  The name of the view.

- **SPECIFIC_CATALOG**
  The name of the catalog to which the function used in the view definition belongs. This value is always **def**.

- **SPECIFIC_SCHEMA**
  The name of the schema (database) to which the function used in the view definition belongs.

- **SPECIFIC_NAME**
  The name of the function used in the view definition.
Chapter 45 The INFORMATION_SCHEMA
VIEW_TABLE_USAGE Table

The `VIEW_TABLE_USAGE` table (available as of MySQL 8.0.13) provides access to information about tables and views used in view definitions.

You can see information only for views for which you have some privilege, and only for tables for which you have some privilege.

The `VIEW_TABLE_USAGE` table has these columns:

- **VIEW_CATALOG**
  The name of the catalog to which the view belongs. This value is always `def`.

- **VIEW_SCHEMA**
  The name of the schema (database) to which the view belongs.

- **VIEW_NAME**
  The name of the view.

- **TABLE_CATALOG**
  The name of the catalog to which the table or view used in the view definition belongs. This value is always `def`.

- **TABLE_SCHEMA**
  The name of the schema (database) to which the table or view used in the view definition belongs.

- **TABLE_NAME**
  The name of the table or view used in the view definition.
Chapter 46 Extensions to SHOW Statements

Some extensions to `SHOW` statements accompany the implementation of `INFORMATION_SCHEMA`:

- `SHOW` can be used to get information about the structure of `INFORMATION_SCHEMA` itself.
- Several `SHOW` statements accept a `WHERE` clause that provides more flexibility in specifying which rows to display.

`INFORMATION_SCHEMA` is an information database, so its name is included in the output from `SHOW DATABASES`. Similarly, `SHOW TABLES` can be used with `INFORMATION_SCHEMA` to obtain a list of its tables:

```sql
mysql> SHOW TABLES FROM INFORMATION_SCHEMA;
+--------------------------+
| Tables_in_INFORMATION_SCHEMA |
+--------------------------+
| CHARACTER_SETS           |
| COLLATIONS               |
| COLLATION_CHARACTER_SET_APPLICABILITY |
| COLUMNS                  |
| COLUMN_PRIVILEGES        |
| ENGINES                  |
| EVENTS                   |
| FILES                    |
| KEY_COLUMN_USAGE         |
| PARTITIONS               |
| PLUGINS                  |
| PROCESSLIST              |
| REFERENTIAL_CONSTRAINTS  |
| Routines                 |
| SCHEMATA                 |
| SCHEMA_PRIVILEGES        |
| STATISTICS               |
| TABLES                   |
| TABLE_CONSTRAINTS        |
| TABLE_PRIVILEGES         |
| TRIGGERS                 |
| USER_PRIVILEGES          |
| VIEWS                    |
+--------------------------+
```

`SHOW COLUMNS` and `DESCRIBE` can display information about the columns in individual `INFORMATION_SCHEMA` tables.

`SHOW` statements that accept a `LIKE` clause to limit the rows displayed also permit a `WHERE` clause that specifies more general conditions that selected rows must satisfy:

```sql
SHOW CHARACTER SET
SHOW COLLATION
SHOW COLUMNS
SHOW DATABASES
SHOW FUNCTION STATUS
SHOW INDEX
SHOW OPEN TABLES
SHOW PROCEDURE STATUS
SHOW STATUS
SHOW TABLE STATUS
SHOW TABLES
SHOW TRIGGERS
SHOW VARIABLES
```

The `WHERE` clause, if present, is evaluated against the column names displayed by the `SHOW` statement. For example, the `SHOW CHARACTER SET` statement produces these output columns:

```sql
mysql> SHOW CHARACTER SET;
+-----------+-----------------------------+---------------------+--------+
| Charset   | Description                 | Default_collation   | Maxlen |
+-----------+-----------------------------+---------------------+--------+
```

109
To use a `WHERE` clause with `SHOW CHARACTER SET`, you would refer to those column names. As an example, the following statement displays information about character sets for which the default collation contains the string 'japanese':

```sql
mysql> SHOW CHARACTER SET WHERE `Default collation` LIKE '%japanese%';
+---------+---------------------------+---------------------+--------+
| Charset | Description               | Default collation   | Maxlen |
|---------+---------------------------+---------------------+--------+
| ujis    | EUC-JP Japanese           | ujis_japanese_ci    |      3 |
| sjis    | Shift-JIS Japanese        | sjis_japanese_ci    |      2 |
| cp932   | SJIS for Windows Japanese | cp932_japanese_ci   |      2 |
| eucjpms | UJIS for Windows Japanese | eucjpms_japanese_ci |      3 |
+---------+---------------------------+---------------------+--------+
```

This statement displays the multibyte character sets:

```sql
mysql> SHOW CHARACTER SET WHERE Maxlen > 1;
+---------+---------------------------+---------------------+--------+
| Charset | Description               | Default collation   | Maxlen |
|---------+---------------------------+---------------------+--------+
| big5    | Big5 Traditional Chinese  | big5_chinese_ci     |      2 |
| ujis    | EUC-JP Japanese           | ujis_japanese_ci    |      3 |
| sjis    | Shift-JIS Japanese        | sjis_japanese_ci    |      2 |
| euckr   | EUC-KR Korean             | euckr_korean_ci     |      2 |
| gb2312  | GB2312 Simplified Chinese | gb2312_chinese_ci   |      2 |
| gbk     | GBK Simplified Chinese    | gbk_chinese_ci      |      2 |
| utf8    | UTF-8 Unicode             | utf8_general_ci     |      3 |
| ucs2    | UCS-2 Unicode             | ucs2_general_ci     |      2 |
| cp932   | SJIS for Windows Japanese | cp932_japanese_ci   |      2 |
| eucjpms | UJIS for Windows Japanese | eucjpms_japanese_ci |      3 |
+---------+---------------------------+---------------------+--------+
```
Chapter 47 MySQL 8.0 FAQ: INFORMATION_SCHEMA

Questions

• **47.1:** Where can I find documentation for the MySQL INFORMATION_SCHEMA database?
• **47.2:** Is there a discussion forum for INFORMATION_SCHEMA?
• **47.3:** Where can I find the ANSI SQL 2003 specification for INFORMATION_SCHEMA?
• **47.4:** What is the difference between the Oracle Data Dictionary and MySQL INFORMATION_SCHEMA?
• **47.5:** Can I add to or otherwise modify the tables found in the INFORMATION_SCHEMA database?

Questions and Answers

47.1: Where can I find documentation for the MySQL INFORMATION_SCHEMA database?

See Chapter 1, INFORMATION_SCHEMA Tables

47.2: Is there a discussion forum for INFORMATION_SCHEMA?


47.3: Where can I find the ANSI SQL 2003 specification for INFORMATION_SCHEMA?

Unfortunately, the official specifications are not freely available. (ANSI makes them available for purchase.) However, there are books available, such as SQL-99 Complete, Really by Peter Gulutzan and Trudy Pelzer, that provide a comprehensive overview of the standard, including INFORMATION_SCHEMA.

47.4: What is the difference between the Oracle Data Dictionary and MySQL INFORMATION_SCHEMA?

Both Oracle and MySQL provide metadata in tables. However, Oracle and MySQL use different table names and column names. The MySQL implementation is more similar to those found in DB2 and SQL Server, which also support INFORMATION_SCHEMA as defined in the SQL standard.

47.5: Can I add to or otherwise modify the tables found in the INFORMATION_SCHEMA database?

No. Since applications may rely on a certain standard structure, this should not be modified. For this reason, we cannot support bugs or other issues which result from modifying INFORMATION_SCHEMA tables or data.