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# MySQL NDB Cluster 9.0 Release Notes

## Abstract

This document contains release notes for the changes in each release of MySQL NDB Cluster that uses version 9.0 of the [NDB \(NDBCLUSTER\)](#) storage engine.

Each NDB Cluster 9.0 release is based on a mainline MySQL Server release and a particular version of the [NDB](#) storage engine, as shown in the version string returned by executing `SELECT VERSION()` in the `mysql` client, or by executing the `ndb_mgm` client `SHOW` or `STATUS` command; for more information, see [MySQL NDB Cluster 9.0](#).

For general information about features added in NDB Cluster 9.0, see [What is New in MySQL NDB Cluster 9.0](#). For a complete list of all bug fixes and feature changes in MySQL NDB Cluster, please refer to the changelog section for each individual NDB Cluster release.

For additional MySQL 9.0 documentation, see the [MySQL 9.0 Reference Manual](#), which includes an overview of features added in MySQL 9.0 that are not specific to NDB Cluster ([What Is New in MySQL 9.0](#)), and discussion of upgrade issues that you may encounter for upgrades from MySQL 8.4 to MySQL 9.0 ([Changes in MySQL 9.0](#)). For a complete list of all bug fixes and feature changes made in MySQL 9.0 that are not specific to [NDB](#), see [MySQL 9.0 Release Notes](#).

Updates to these notes occur as new product features are added, so that everybody can follow the development process. If a recent version is listed here that you cannot find on the download page (<https://dev.mysql.com/downloads/>), the version has not yet been released.

The documentation included in source and binary distributions may not be fully up to date with respect to release note entries because integration of the documentation occurs at release build time. For the most up-to-date release notes, please refer to the online documentation instead.

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

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

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## Preface and Legal Notices

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## Changes in MySQL NDB Cluster 9.0.0 (2024-07-02, Innovation Release)

MySQL NDB Cluster 9.0.0 is a new Innovation release of NDB Cluster, based on MySQL Server 9.0 and including features in version 9.0 of the [NDB](#) storage engine, as well as fixing recently discovered bugs in previous NDB Cluster releases.

**Obtaining MySQL NDB Cluster 9.0.** NDB Cluster 9.0 source code and binaries can be obtained from <https://dev.mysql.com/downloads/cluster/>.

For an overview of major changes made in NDB Cluster 9.0, see [What is New in MySQL NDB Cluster 9.0](#).

This release also incorporates all bug fixes and changes made in previous NDB Cluster releases, as well as all bug fixes and feature changes which were added in mainline MySQL 9 through MySQL 9.0.0 (see [Changes in MySQL 9.0.0 \(2024-07-01, Innovation Release\)](#)).

- [Deprecation and Removal Notes](#)
- [Performance Schema Notes](#)
- [Functionality Added or Changed](#)
- [Bugs Fixed](#)

## Deprecation and Removal Notes

- **NDB Cluster APIs:** [Node.js](#) support in MySQL NDB Cluster is now deprecated, and you should expect its removal in a future release.

You can also find the NDB Cluster [jones-ndb](#) driver for [Node.js](#) at <https://github.com/mysql/mysql-js>, where it remains available to interested users. (WL #16245)

- **NDB Client Programs:** The `ndb_size.pl` utility is now deprecated and is no longer supported. You can expect it to be removed from a future version of the NDB Cluster distribution; for this reason, you should now modify any applications which depend on it accordingly. (WL #16456)

## Performance Schema Notes

- **NDB Replication:** Previously, information about the NDB replication applier was available to the user only as a set of server status variables, and only for the default replication channel.

This release implements a new Performance Schema `ndb_replication_applier_status` table, which can be thought of as an NDB-specific extension to the existing `replication_applier_status` table. This enhancement provides per-channel information about an applier's status, including information relating to NDB Cluster conflict detection and resolution, in table form.

For more information about this table, see [The `ndb\_replication\_applier\_status` Table](#). For information about replication in NDB Cluster, see [NDB Cluster Replication](#). (WL #16013)

## Functionality Added or Changed

- **Important Change:** Now, when the removal of a data node file or directory fails with a file does not exist (`ENOENT`) error, this is treated as a successful removal.
- **ndbinfo Information Database:** Added a `type` column to the `transporter_details` table in the `ndbinfo` information database. This column shows the type of connection used by the transporter, which is either of `TCP` or `SHM`.
- **NDB Client Programs:** Added the `--CA-days` option to `ndb_sign_keys` to make it possible to specify a certificate's lifetime. (Bug #36549567)
- **NDB Client Programs:** When started, `ndbd` now produces a warning in the data node log like this one:

```
2024-05-28 13:32:16 [ndbd] WARNING -- Running ndbd with a single thread of
signal execution. For multi-threaded signal execution run the ndbmtb binary.
```

(Bug #36326896)

## Bugs Fixed

- **NDB Cluster APIs:** TLS connection errors were printed even though TLS was not specified for connections.

To fix this issue, following an ignored TLS error, we explicitly reset the error condition in the management handle to `NO_ERROR`. (Bug #36354973)

- **NDB Cluster APIs:** It was possible to employ the following NDB API methods without them being used as `const`, although this alternative usage had long been deprecated (and was not actually documented):

- `Dictionary::listEvents()`
- `Dictionary::listIndexes()`
- `Dictionary::listObjects()`
- `NdbOperation::getNdbErrorLine()`

Now, each of these methods must always be invoked as `const`. (Bug #36165876)

- **NDB Client Programs:** In some cases, it was not possible to load certificates generated using `ndb_sign_keys`. (Bug #36430004)

- **NDB Client Programs:** `ndb_redo_log_reader` could not read data from encrypted files. (Bug #36313482)
- **NDB Client Programs:** The following command-line options did not function correctly for the `ndb_redo_log_reader` utility program:
  - `--mbyte`
  - `--page`
  - `--pageindex`
 (Bug #36313427)
- **NDB Client Programs:** `ndb_redo_log_reader` exited with `Record type = 0 not implemented` when reaching an unused page, all zero bytes, or a page which was only partially used (typically a page consisting of the page header only). (Bug #36313259)
- **NDB Client Programs:** `ndb_restore` did not restore a foreign key whose columns differed in order from those of the parent key.
 

Our thanks to Axel Svensson for the contribution. (Bug #114147, Bug #36345882)
- Removed a memory leak in `/util/NodeCertificate.cpp`. (Bug #36537931)
- Removed a memory leak from `src/ndbapi/NdbDictionaryImpl.cpp`. (Bug #36532102)
- When building NDB using `lld`, the build terminated prematurely with the error message `ld.lld: error: version script assignment of 'local' to symbol 'my_init' failed: symbol not defined while attempting to link libndbclient.so`. (Bug #36431274)
- TLS did not fail cleanly on systems which used OpenSSL 1.0, which is unsupported. Now in such cases, users get a clear error message advising that an upgrade to OpenSSL 1.1 or later is required to use TLS with NDB Cluster. (Bug #36426461)
- The included `libxml2` library was updated to version 2.9.13. (Bug #36417013)
- Setting `AutomaticThreadConfig` and `NumCPUs` when running single-threaded data nodes (`ndbd`) sometimes led to unrecoverable errors. Now `ndbd` ignores settings for these parameters, which are intended to apply only to multi-threaded data nodes (`ndbmtbd`). (Bug #36388981)
- The handling of the `LQH` operation pool which occurs as part of TC takeover skipped the last element in either of the underlying physical pools (static or dynamic). If this element was in use, holding an operation record for a transaction belonging to a transaction coordinator on the failed node, it was not returned, resulting in an incomplete takeover which sometimes left operations behind. Such operations interfered with subsequent transactions and the copying process (`CopyFrag`) used by the failed node to recover.
 

To fix this problem, we avoid skipping the final record while iterating through the `LQH` operation records during TC takeover. (Bug #36363119)
- The `libssh` library was updated to version 0.10.4. (Bug #36135621)
- When distribution awareness was not in use, the cluster tended to choose the same data node as the transaction coordinator repeatedly. (Bug #35840020, Bug #36554026)
- In certain cases, management nodes were unable to allocate node IDs to restarted data and SQL nodes. (Bug #35658072)
- In some cases, when trying to perform an online add index operation on an NDB table with no explicit primary key (see [Limitations of NDB online operations](#)), the resulting error message did not make the nature of the problem clear. (Bug #30766579)

References: See also: Bug #36382071.

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