19.8. Error Reporting and Logging

19.8.1. Where To Log

`log_destination` (`string`)

PostgreSQL supports several methods for logging server messages, including stderr, csvlog and syslog. On Windows, eventlog is also supported. Set this parameter to a list of desired log destinations separated by commas. The default is to log to stderr only. This parameter can only be set in the `postgresql.conf` file or on the server command line.

If csvlog is included in `log_destination`, log entries are output in "comma separated value" (CSV) format, which is convenient for loading logs into programs. See Section 19.8.4 for details. logging_collector must be enabled to generate CSV-format log output.

Note: On most Unix systems, you will need to alter the configuration of your system's syslog daemon in order to make use of the syslog option for `log_destination`. PostgreSQL can log to syslog facilities `LOCAL0` through `LOCAL7` (see syslog_facility), but the default syslog configuration on most platforms will discard all such messages. You will need to add something like:

```
local0.*    /var/log/postgresql
```

to the syslog daemon's configuration file to make it work.

On Windows, when you use the `eventlog` option for `log_destination`, you should register an event source and its library with the operating system so that the Windows Event Viewer can display event log messages cleanly. See Section 18.11 for details.

`logging_collector` (`boolean`)

This parameter enables the *logging collector*, which is a background process that captures log messages sent to stderr and redirects them into log files. This approach is often more useful than logging to syslog, since some types of messages might not appear in syslog output. (One common example is dynamic-linker failure messages; another is error messages produced by scripts such as `archive_command`.) This parameter can only be set at server start.

Note: It is possible to log to stderr without using the logging collector; the log messages will just go to wherever the server's stderr is directed. However, that method is only suitable for low log volumes, since it provides no convenient way to rotate log files. Also, on some platforms not using the logging collector can result in lost or garbled log output, because multiple processes writing concurrently to the same log file can overwrite each other's output.

> **Note:** The logging collector is designed to never lose messages. This means that in case of extremely high load, server processes could be blocked while trying to send additional log messages when the collector has fallen behind. In contrast, syslog prefers to drop messages if it cannot write them, which means it may fail to log some messages in such cases but it will not block the rest of the system.

`log_directory` (`string`)

When `logging_collector` is enabled, this parameter determines the directory in which log files will be created. It can be specified as an absolute path, or relative to the cluster data directory. This parameter can only be set in the `postgresql.conf` file or on the server command line. The default is `pg_log`.

`log_filename` (`string`)

When `logging_collector` is enabled, this parameter sets the file names of the created log files. The value is treated as a `strftime` pattern, so `%`-escapes can be used to specify time-varying file names. (Note that if there are any time-zone-dependent `%`-escapes, the computation is done in the zone specified by log_timezone.) The supported `%`-escapes are similar to those listed in the Open Group's strftime specification. Note that the system's `strftime` is not used directly, so platform-specific (nonstandard) extensions do not work. The default is `postgresql-%Y-%m-%d_%H%M%S.log`.

If you specify a file name without escapes, you should plan to use a log rotation utility to avoid eventually filling the entire disk. In releases prior to 8.4, if no `%` escapes were present, PostgreSQL would append the epoch of the new log file's creation time, but this is no longer the case.

If CSV-format output is enabled in `log_destination`, `.csv` will be appended to the timestamped log file name to create the file name for CSV-format output. (If `log_filename` ends in `.log`, the suffix is replaced instead.)

This parameter can only be set in the `postgresql.conf` file or on the server command line.

`log_file_mode` (`integer`)

On Unix systems this parameter sets the permissions for log files when `logging_collector` is enabled. (On Microsoft Windows this parameter is ignored.) The parameter value is expected to be a numeric mode specified in the format accepted by the `chmod` and `umask` system calls. (To use the customary octal format the number must start with a `0` (zero).)

The default permissions are `0600`, meaning only the server owner can read or write the log files. The other commonly useful setting is `0640`, allowing members of the owner's group to read the files. Note however that to make use of such a setting, you'll need to alter log_directory to store the files somewhere outside the cluster data directory. In any case, it's unwise to make the log files world-readable, since they might contain sensitive data.

This parameter can only be set in the `postgresql.conf` file or on the server command line.

`log_rotation_age` (`integer`)

When `logging_collector` is enabled, this parameter determines the maximum lifetime of an individual log file. After this many minutes have elapsed, a new log file will be created. Set to zero to disable time-based creation of new log files. This parameter can only be set in the `postgresql.conf` file or on the server command line.

`log_rotation_size` (`integer`)

When `logging_collector` is enabled, this parameter determines the maximum size of an individual log file. After this many kilobytes have been emitted into a log file, a new log file will be created. Set to zero to disable size-based creation of new log files. This parameter can only be set in the `postgresql.conf` file or on the server command line.

`log_truncate_on_rotation` (`boolean`)

When `logging_collector` is enabled, this parameter will cause PostgreSQL to truncate (overwrite), rather than append to, any existing log file of the same name. However, truncation will occur only when a new file is being opened due to time-based rotation, not during server startup or size-based rotation. When off, pre-existing files will be appended to in all cases. For example, using this setting in combination with a `log_filename` like `postgresql-%H.log` would result in generating twenty-four hourly log files and then cyclically overwriting them. This parameter can only be set in the `postgresql.conf` file or on the server command line.

Example: To keep 7 days of logs, one log file per day named `server_log.Mon`, `server_log.Tue`, etc, and automatically overwrite last week's log with this week's log, set `log_filename` to `server_log.%a`, `log_truncate_on_rotation` to `on`, and `log_rotation_age` to `1440`.

Example: To keep 24 hours of logs, one log file per hour, but also rotate sooner if the log file size exceeds 1GB, set `log_filename` to `server_log.%H%M`, `log_truncate_on_rotation` to `on`, `log_rotation_age` to `60`, and `log_rotation_size` to `1000000`. Including `%M` in `log_filename` allows any size-driven rotations that might occur to select a file name different from the hour's initial file name.

`syslog_facility` (`enum`)

When logging to syslog is enabled, this parameter determines the syslog "facility" to be used. You can choose from `LOCAL0`, `LOCAL1`, `LOCAL2`, `LOCAL3`, `LOCAL4`, `LOCAL5`, `LOCAL6`, `LOCAL7`; the default is `LOCAL0`. See also the documentation of your system's syslog daemon. This parameter can only be set in the `postgresql.conf` file or on the server command line.

`syslog_ident` (`string`)

When logging to syslog is enabled, this parameter determines the program name used to identify PostgreSQL messages in syslog logs. The default is `postgres`. This parameter can only be set in the `postgresql.conf` file or on the server command line.

`syslog_sequence_numbers` (`boolean`)

When logging to syslog and this is on (the default), then each message will be prefixed by an increasing sequence number (such as `[2]`). This circumvents the "--- last message repeated N times --- " suppression that many syslog implementations perform by default. In more modern syslog implementations, repeated message suppression can be configured (for example, `$RepeatedMsgReduction` in rsyslog), so this might not be necessary. Also, you could turn this off if you actually want to suppress repeated messages.

This parameter can only be set in the `postgresql.conf` file or on the server command line.

`syslog_split_messages` (`boolean`)

When logging to syslog is enabled, this parameter determines how messages are delivered to syslog. When on (the default), messages are split by lines, and long lines are split so that they will fit into 1024 bytes, which is a typical size limit for traditional syslog implementations. When off, PostgreSQL server log messages are delivered to the syslog service as is, and it is up to the syslog service to cope with the potentially bulky messages.

If syslog is ultimately logging to a text file, then the effect will be the same either way, and it is best to leave the setting on, since most syslog implementations either cannot handle large messages or would need to be specially configured to handle them. But if syslog is ultimately writing into some other medium, it might be necessary or more useful to keep messages logically together.

This parameter can only be set in the `postgresql.conf` file or on the server command line.

`event_source` (`string`)

When logging to event log is enabled, this parameter determines the program name used to identify PostgreSQL messages in the log. The default is `PostgreSQL`. This parameter can only be set in the `postgresql.conf` file or on the server command line.

19.8.2. When To Log

`client_min_messages` (`enum`)

Controls which message levels are sent to the client. Valid values are `DEBUG5`, `DEBUG4`, `DEBUG3`, `DEBUG2`, `DEBUG1`, `LOG`, `NOTICE`, `WARNING`, `ERROR`, `FATAL`, and `PANIC`. Each level includes all the levels that follow it. The later the level, the fewer messages are sent. The default is `NOTICE`. Note that `LOG` has a different rank here than in `log_min_messages`.

`log_min_messages` (`enum`)

Controls which message levels are written to the server log. Valid values are `DEBUG5`, `DEBUG4`, `DEBUG3`, `DEBUG2`, `DEBUG1`, `INFO`, `NOTICE`, `WARNING`, `ERROR`, `LOG`, `FATAL`, and `PANIC`. Each level includes all the levels that follow it. The later the level, the fewer messages are sent to the log. The default is `WARNING`. Note that `LOG` has a different rank here than in `client_min_messages`. Only superusers can change this setting.

`log_min_error_statement` (`enum`)

Controls which SQL statements that cause an error condition are recorded in the server log. The current SQL statement is included in the log entry for any message of the specified severity or higher. Valid values are `DEBUG5`, `DEBUG4`, `DEBUG3`, `DEBUG2`, `DEBUG1`, `INFO`, `NOTICE`, `WARNING`, `ERROR`, `LOG`, `FATAL`, and `PANIC`. The default is `ERROR`, which means statements causing errors, log messages, fatal errors, or panics will be logged. To effectively turn off logging of failing statements, set this parameter to `PANIC`. Only superusers can change this setting.

`log_min_duration_statement` (`integer`)

Causes the duration of each completed statement to be logged if the statement ran for at least the specified number of milliseconds. Setting this to zero prints all statement durations. Minus-one (the default) disables logging statement durations. For example, if you set it to `250ms` then all SQL statements that run 250ms or longer will be logged. Enabling this parameter can be helpful in tracking down unoptimized queries in your applications. Only superusers can change this setting.

For clients using extended query protocol, durations of the Parse, Bind, and Execute steps are logged independently.

> **Note:** When using this option together with log_statement, the text of statements that are logged because of `log_statement` will not be repeated in the duration log message. If you are not using syslog, it is recommended that you log the PID or session ID using log_line_prefix so that you can link the statement message to the later duration message using the process ID or session ID.

Table 19-1 explains the message severity levels used by PostgreSQL. If logging output is sent to syslog or Windows' eventlog, the severity levels are translated as shown in the table.

Table 19-1. Message Severity Levels

Severity	Usage	syslog	eventlog

`DEBUG1..DEBUG5`	Provides successively-more-detailed information for use by developers.	`DEBUG`	`INFORMATION`
`INFO`	Provides information implicitly requested by the user, e.g., output from `VACUUM VERBOSE`.	`INFO`	`INFORMATION`
`NOTICE`	Provides information that might be helpful to users, e.g., notice of truncation of long identifiers.	`NOTICE`	`INFORMATION`
`WARNING`	Provides warnings of likely problems, e.g., `COMMIT` outside a transaction block.	`NOTICE`	`WARNING`
`ERROR`	Reports an error that caused the current command to abort.	`WARNING`	`ERROR`
`LOG`	Reports information of interest to administrators, e.g., checkpoint activity.	`INFO`	`INFORMATION`
`FATAL`	Reports an error that caused the current session to abort.	`ERR`	`ERROR`
`PANIC`	Reports an error that caused all database sessions to abort.	`CRIT`	`ERROR`

19.8.3. What To Log

`application_name` (`string`)

The `application_name` can be any string of less than `NAMEDATALEN` characters (64 characters in a standard build). It is typically set by an application upon connection to the server. The name will be displayed in the `pg_stat_activity` view and included in CSV log entries. It can also be included in regular log entries via the log_line_prefix parameter. Only printable ASCII characters may be used in the `application_name` value. Other characters will be replaced with question marks (`?`).

`debug_print_parse` (`boolean`)
`debug_print_rewritten` (`boolean`)
`debug_print_plan` (`boolean`)

These parameters enable various debugging output to be emitted. When set, they print the resulting parse tree, the query rewriter output, or the execution plan for each executed query. These messages are emitted at `LOG` message level, so by default they will appear in the server log but will not be sent to the client. You can change that by adjusting client_min_messages and/or log_min_messages. These parameters are off by default.

`debug_pretty_print` (`boolean`)

When set, `debug_pretty_print` indents the messages produced by `debug_print_parse`, `debug_print_rewritten`, or `debug_print_plan`. This results in more readable but much longer output than the "compact" format used when it is off. It is on by default.

`log_checkpoints` (`boolean`)

Causes checkpoints and restartpoints to be logged in the server log. Some statistics are included in the log messages, including the number of buffers written and the time spent writing them. This parameter can only be set in the `postgresql.conf` file or on the server command line. The default is off.

`log_connections` (`boolean`)

Causes each attempted connection to the server to be logged, as well as successful completion of client authentication. Only superusers can change this parameter at session start, and it cannot be changed at all within a session. The default is `off`.

> **Note:** Some client programs, like psql, attempt to connect twice while determining if a password is required, so duplicate "connection received" messages do not necessarily indicate a problem.

`log_disconnections` (`boolean`)

Causes session terminations to be logged. The log output provides information similar to `log_connections`, plus the duration of the session. Only superusers can change this parameter at session start, and it cannot be changed at all within a session. The default is `off`.

`log_duration` (`boolean`)

Causes the duration of every completed statement to be logged. The default is `off`. Only superusers can change this setting.

For clients using extended query protocol, durations of the Parse, Bind, and Execute steps are logged independently.

> **Note:** The difference between setting this option and setting log_min_duration_statement to zero is that exceeding `log_min_duration_statement` forces the text of the query to be logged, but this option doesn't. Thus, if `log_duration` is `on` and `log_min_duration_statement` has a positive value, all durations are logged but the query text is included only for statements exceeding the threshold. This behavior can be useful for gathering statistics in high-load installations.

`log_error_verbosity` (`enum`)

Controls the amount of detail written in the server log for each message that is logged. Valid values are `TERSE`, `DEFAULT`, and `VERBOSE`, each adding more fields to displayed messages. `TERSE` excludes the logging of `DETAIL`, `HINT`, `QUERY`, and `CONTEXT` error information. `VERBOSE` output includes the `SQLSTATE` error code (see also Appendix A) and the source code file name, function name, and line number that generated the error. Only superusers can change this setting.

`log_hostname` (`boolean`)

By default, connection log messages only show the IP address of the connecting host. Turning this parameter on causes logging of the host name as well. Note that depending on your host name resolution setup this might impose a non-negligible performance penalty. This parameter can only be set in the `postgresql.conf` file or on the server command line.

`log_line_prefix` (`string`)

This is a `printf`-style string that is output at the beginning of each log line. `%` characters begin "escape sequences" that are replaced with status information as outlined below. Unrecognized escapes are ignored. Other characters are copied straight to the log line. Some escapes are only recognized by session processes, and will be treated as empty by background processes such as the main server process. Status information may be aligned either left or right by specifying a numeric literal after the % and before the option. A negative value will cause the status information to be padded on the right with spaces to give it a minimum width, whereas a positive value will pad on the left. Padding can be useful to aid human readability in log files. This parameter can only be set in the `postgresql.conf` file or on the server command line. The default is an empty string.

Escape	Effect	Session only
`%a`	Application name	yes
`%u`	User name	yes
`%d`	Database name	yes
`%r`	Remote host name or IP address, and remote port	yes
`%h`	Remote host name or IP address	yes
`%p`	Process ID	no

Escape	Effect	Session only
`%t`	Time stamp without milliseconds	no
`%m`	Time stamp with milliseconds	no
`%n`	Time stamp with milliseconds (as a Unix epoch)	no
`%i`	Command tag: type of session's current command	yes
`%e`	SQLSTATE error code	no
`%c`	Session ID: see below	no
`%l`	Number of the log line for each session or process, starting at 1	no
`%s`	Process start time stamp	no
`%v`	Virtual transaction ID (backendID/localXID)	no
`%x`	Transaction ID (0 if none is assigned)	no
`%q`	Produces no output, but tells non-session processes to stop at this point in the string; ignored by session processes	no
`%%`	Literal `%`	no

The `%c` escape prints a quasi-unique session identifier, consisting of two 4-byte hexadecimal numbers (without leading zeros) separated by a dot. The numbers are the process start time and the process ID, so `%c` can also be used as a space saving way of printing those items. For example, to generate the session identifier from `pg_stat_activity`, use this query:

```
SELECT to_hex(trunc(EXTRACT(EPOCH FROM backend_start))::integer) || '.' ||
       to_hex(pid)
FROM pg_stat_activity;
```

Tip: If you set a nonempty value for `log_line_prefix`, you should usually make its last character be a space, to provide visual separation from the rest of the log line. A punctuation character can be used too.

Tip: Syslog produces its own time stamp and process ID information, so you probably do not want to include those escapes if you are logging to syslog.

`log_lock_waits` (`boolean`)

Controls whether a log message is produced when a session waits longer than deadlock_timeout to acquire a lock. This is useful in determining if lock waits are causing poor performance. The default is `off`.

`log_statement` (`enum`)

Controls which SQL statements are logged. Valid values are `none` (off), `ddl`, `mod`, and `all` (all statements). `ddl` logs all data definition statements, such as `CREATE`, `ALTER`, and `DROP` statements. `mod` logs all `ddl` statements, plus data-modifying statements such as `INSERT`, `UPDATE`, `DELETE`, `TRUNCATE`, and `COPY FROM`. `PREPARE`, `EXECUTE`, and `EXPLAIN ANALYZE` statements are also logged if their contained command is of an appropriate type. For clients using extended query protocol, logging occurs when an Execute message is received, and values of the Bind parameters are included (with any embedded single-quote marks doubled).

The default is `none`. Only superusers can change this setting.

Note: Statements that contain simple syntax errors are not logged even by the `log_statement` = `all` setting, because the log message is emitted only after basic parsing has been done to determine the statement type. In the case of extended query protocol, this setting likewise does not log statements that fail before the Execute phase (i.e., during parse analysis or planning). Set `log_min_error_statement` to `ERROR` (or lower) to log such statements.

`log_replication_commands` (`boolean`)

Causes each replication command to be logged in the server log. See Section 51.3 for more information about replication command. The default value is `off`. Only superusers can change this setting.

`log_temp_files` (`integer`)

Controls logging of temporary file names and sizes. Temporary files can be created for sorts, hashes, and temporary query results. A log entry is made for each temporary file when it is deleted. A value of zero logs all temporary file information, while positive values log only files whose size is greater than or equal to the specified number of kilobytes. The default setting is -1, which disables such logging. Only superusers can change this setting.

`log_timezone` (`string`)

Sets the time zone used for timestamps written in the server log. Unlike TimeZone, this value is cluster-wide, so that all sessions will report timestamps consistently. The built-in default is `GMT`, but that is typically overridden in `postgresql.conf`; initdb will install a setting there corresponding to its system environment. See Section 8.5.3 for more information. This parameter can only be set in the `postgresql.conf` file or on the server command line.

19.8.4. Using CSV-Format Log Output

Including `csvlog` in the `log_destination` list provides a convenient way to import log files into a database table. This option emits log lines in comma-separated-values (CSV) format, with these columns: time stamp with milliseconds, user name, database name, process ID, client host:port number, session ID, per-session line number, command tag, session start time, virtual transaction ID, regular transaction ID, error severity, SQLSTATE code, error message, error message detail, hint, internal query that led to the error (if any), character count of the error position therein, error context, user query that led to the error (if any and enabled by `log_min_error_statement`), character count of the error position therein, location of the error in the PostgreSQL source code (if `log_error_verbosity` is set to `verbose`), and application name. Here is a sample table definition for storing CSV-format log output:

```
CREATE TABLE postgres_log
(
  log_time timestamp(3) with time zone,
  user_name text,
  database_name text,
  process_id integer,
  connection_from text,
  session_id text,
  session_line_num bigint,
  command_tag text,
  session_start_time timestamp with time zone,
  virtual_transaction_id text,
  transaction_id bigint,
  error_severity text,
  sql_state_code text,
  message text,
  detail text,
  hint text,
  internal_query text,
  internal_query_pos integer,
  context text,
  query text,
  query_pos integer,
  location text,
  application_name text,
  PRIMARY KEY (session_id, session_line_num)
);
```

To import a log file into this table, use the `COPY FROM` command:

```
COPY postgres_log FROM '/full/path/to/logfile.csv' WITH csv;
```

There are a few things you need to do to simplify importing CSV log files:

1. Set `log_filename` and `log_rotation_age` to provide a consistent, predictable naming scheme for your log files. This lets you predict what the file name will be and know when an individual log file is complete and therefore ready to be imported.

2. Set `log_rotation_size` to 0 to disable size-based log rotation, as it makes the log file name difficult to predict.

3. Set `log_truncate_on_rotation` to `on` so that old log data isn't mixed with the new in the same file.

4. The table definition above includes a primary key specification. This is useful to protect against accidentally importing the same information twice. The `COPY` command commits all of the data it imports at one time, so any error will cause the entire import to fail. If you import a partial log file and later import the file again when it is complete, the primary key violation will cause the import to fail. Wait until the log is complete and closed before importing. This procedure will also protect against accidentally importing a partial line that hasn't been completely written, which would also cause `COPY` to fail.

19.8.5. Process Title

These settings control how process titles of server processes are modified. Process titles are typically viewed using programs like ps or, on Windows, Process Explorer. See Section 28.1 for details.

`cluster_name` (`string`)

Sets the cluster name that appears in the process title for all server processes in this cluster. The name can be any string of less than `NAMEDATALEN` characters (64 characters in a standard build). Only printable ASCII characters may be used in the `cluster_name` value. Other characters will be replaced with question marks (`?`). No name is shown if this parameter is set to the empty string `''` (which is the default). This parameter can only be set at server start.

`update_process_title` (`boolean`)

Enables updating of the process title every time a new SQL command is received by the server. This setting defaults to `on` on most platforms, but it defaults to `off` on Windows due to that platform's larger overhead for updating the process title. Only superusers can change this setting.

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