Data Warehouse Service

Product Bulletin

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Contents

1 Product Notice

1.1 Checking the GaussDB(DWS) Version

The cluster version of GaussDB(DWS) displayed on the management console is in the format of x.y.z.p, which is explained in **Figure 2-1**.

Generally, new functions and features of GaussDB(DWS) are released based on the release number. For example, 8.1.3 and 8.2.0 are iteration versions. New features are added to new versions. For details about the version lifecycle, see **Version Lifecycle**.

After each iteration version is released, a patch is released to fix problems, for example, patch 8.1.3.322. A patch only fixes problems and does not add new functions or features.

Figure 1-1 GaussDB(DWS) version description

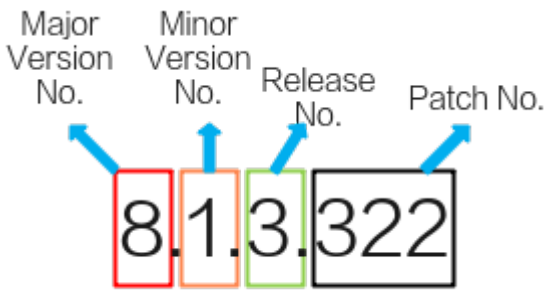
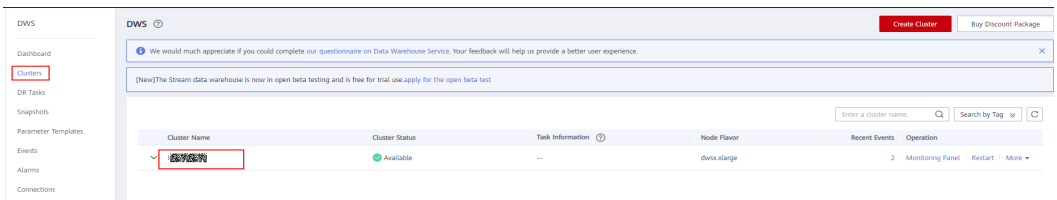


Table 1-1 GaussDB(DWS) cluster version mapping

Released On	Cluster Version	Database Kernel Version	Description
2023-11-02	**8.1.3.325 (recommended version)**	8.1.3	1.3.1 New Features in 8.1.3
2023-10-16	8.1.3.323		
2023-08-04	8.1.3.322		
2023-06-26	8.1.3.321		
2023-05-19	8.1.3.320		
2023-03-09	8.1.3.310		
2022-12-19	8.1.3.300		
2022-10-31	8.1.3.200		
2022-08-23	8.1.3.110		
2022-06-20	8.1.3.100		
2022-04-15	8.1.3		
2022-06-20	8.1.1.500	8.1.1	1.4 Version 8.1.1
2022-04-15	8.1.1.300		
2022-03-30	8.1.1.205		
2022-03-18	8.1.1.203		
2022-02-24	8.1.1.202		
2022-01-25	8.1.1.201		
2021-12-09	8.1.1.200		
2021-07-30	8.1.1.100		

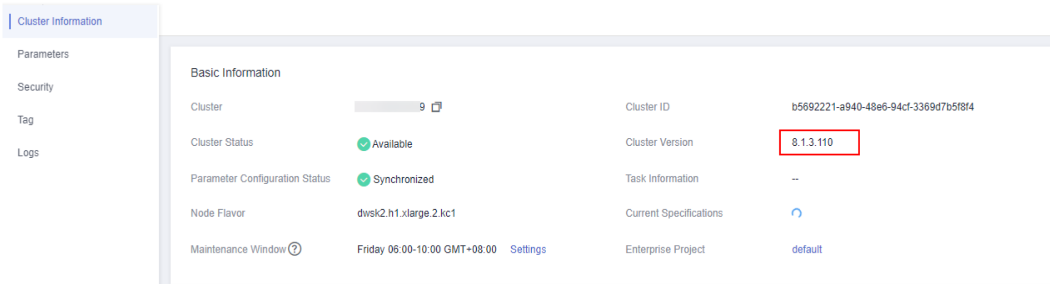
Querying the Cluster Version

Step 1 Log in to the GaussDB(DWS) console. In the navigation pane, Choose **Clusters**.



Step 2 In the cluster list, find the target cluster and click the cluster name. The **Basic Information** tab is displayed.

The cluster version is 8.1.3.110.

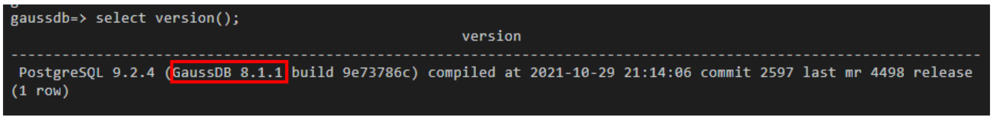


----End

Querying the Database Kernel Version

- Method 1: Query the cluster version by referring to **Querying the Cluster Version** and find the corresponding database kernel version in **Table 1-1**.
- Method 2: Connect to the GaussDB(DWS) database. Run the following SQL statement:

```
select version();
```



1.2 New Features in 9.1.0.x

NOTE

The beta features discussed below are not available for commercial use. Search for technical support before utilizing these features.

Version 9.1.0.210 (November 25, 2024)

Storage-compute decoupling

1. You can use the **explain warmup** command to preload data into the local disk cache, either at the cold or hot end.
2. The enhanced elastic VW function offers more flexible ways to distribute services. Services can be distributed to either the primary VW or the elastic VW by CN.
3. Storage-compute decoupled tables support parallel insert operations, which improves data loading performance.
4. The storage-compute decoupled table has a recycle bin feature. This allows you to quickly recover from misoperations such as dropping or truncating a table or partition.
5. Both hot and cold tables can utilize disk cache and asynchronous I/Os to improve performance.

Real-time data warehouse

1. The performance for **limit...offset** page turning and **inlist** operations has been significantly improved.
2. The Binlog feature is now available for commercial use.
3. Automatic partitioning now supports time columns of both integer and variable-length types.

Lakehouse

1. Parquet/ORC read and write now support the zstd compression format.
2. The **create table like** command now allows using a table from an external schema as the source table.
3. Foreign tables can be exported in parallel.

High availability

1. Storage-compute decoupled tables and hot and cold tables support incremental backup and restoration.
2. In storage-compute decoupling scenarios, parallel copy is used to increase backup speed.

Ecosystem compatibility

1. The system is compatible with the replace into syntax of MySQL and the interval time type.
2. The **pg_get_tabledef** export function now displays comments.

O&M and stability improvement

1. When disk usage is high, data can be dumped from the standby node to OBS.
2. When the database is about to become read-only, certain statements that write to disks and generate new tables and physical files are intercepted to quickly reclaim disk space and ensure the execution of other statements.
3. Audit logs can be dumped to OBS.
4. The lightweight lock view **pgxc_lwlocks** is added.
5. The common lock view now includes lock acquisition and wait time stamps.
6. The global deadlock detection function is now enabled by default.
7. A lock function is added between VACUUM FULL and SELECT.
8. The expiration time has been added to **gs_view_invalid** to assist O&M personnel in clearing invalid objects.

Constraints

1. The maximum number of VWs supported is 256, with each VW supporting a maximum of 1,024 DNs. It is best to have no more than 32 VWs, with each VW containing no more than 128 DNs.
2. OBS storage-compute decoupled tables do not support DR or fine-grained backup and restoration.

Behavior changes

1. Enabling the **max_process_memory** adaptation during the upgrade and using the active/standby mode will increase the available memory of DNs.
2. By default, data consistency check is enabled for data redistribution during scale-out, which increases the scale-out time by 10%.
3. Create an **Hstore_opt** table with the Turbo engine enabled and retain the default value **middle** for the compression level.
4. By default, the OBS path of a storage-compute decoupled table is displayed as a relative path.
5. To use the disk cache, enable the asynchronous I/O parameter.
6. The interval for clearing indexes of column-store tables has been changed from 1 hour to 10 minutes to quickly clear the occupied index space.
7. **CREATE TABLE** and **ALTER TABLE** do not support columns with the **ON UPDATE** expression as distribution columns.
8. During Parquet data query, the timestamp data saved in INT96 format is not adjusted for 8 hours.
9. **max_stream_pool** is used to control the number of threads cached in the stream thread pool. The default value is changed from **65525** to **1024** to prevent idle threads from using too much memory.
10. The **track_activity_query_size** parameter takes effect upon restart instead of dynamically.
11. The logical replication function is no longer supported, and an error will be reported when related APIs are called.

Patch 9.1.0.105 (October 23, 2024)

This is a patch version that fixes known issues.

Patch 9.1.0.102 (September 25, 2024)

This is a patch version that fixes known issues.

Upgrade

1. Upgrade from 9.0.3 to 9.1.0 is supported.

Fixed known issues

1. Supported **alter database xxx rename to yyy** in the storage-compute decoupling version.
2. Fixed the problem of incorrect display of storage-compute decoupling table's \d+ space size.
3. Fixed the problem of asynchronous sorting not running post backup and restoration.
4. Fixed the problem of inability to use **Create Table Like** syntax after deleting the **bitmap index** column.
5. Fixed the performance rollback problem in Turbo engine's **group by** scenario caused by **hash** algorithm conflicts.

6. Maintained the scheduler processes' handling of failed tasks in the same manner as version 8.3.0.
7. Fixed the problem of **pg_stat_object** space expansion in fault scenario.
8. Fixed the problem of DataArts Studio reporting an error when delivering a **Vacuum Full** job after upgrading from 8.3.0 to 9.1.0.
9. Fixed the problem of high CPU and memory usage during **JSON** field calculation.

Enhanced functions

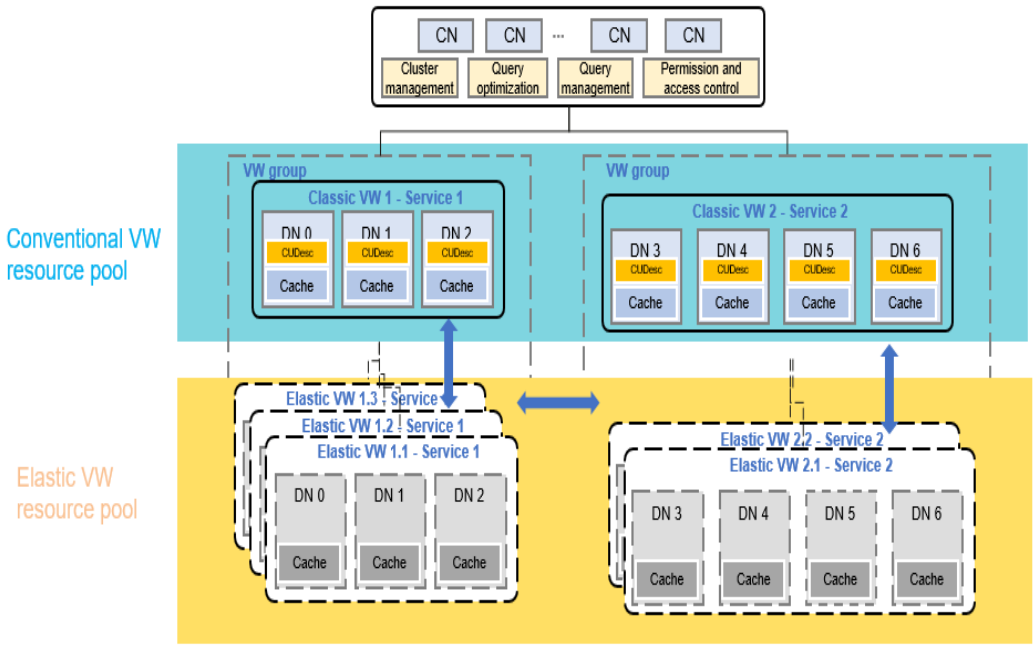
1. ORC foreign tables support the ZSTD compression format.
2. GIS supports the **st_asmvtgeom**, **st_asmvt**, and **st_squaregrid** functions.

Version 9.1.0.100 (August 12, 2024)

Elastic architecture

1. Architecture upgrade: The storage-compute decoupling architecture 3.0, based on OBS, introduces layered and elastic computing and storage, with on-demand storage charging to reduce costs and improve efficiency. Multiple virtual warehouses (VWs) can be deployed to enhance service isolation and resolve resource contention.
2. The elastic VW feature, which is stateless and supports read/write acceleration, addresses issues like insufficient concurrent processing, unbalanced peak and off-peak hours, and resource contention for data loading and analytics. For details, see **Elastically Adding or Deleting a Logical Cluster**.
3. Both auto scale-out and classic scale-out are supported when adding or deleting DNs. Auto scale-out does not redistribute data on OBS, while classic scale-out redistributes all data. The system automatically selects the scale-out mode based on the total number of buckets and DNs.
4. The storage-compute decoupling architecture (DWS 3.0) enhances performance with disk cache and asynchronous I/O read/write. When the disk cache is fully utilized, performance matches that of the storage-compute integration architecture (DWS 2.0).

Figure 1-2 Decoupled storage and compute



Real-time processing

1. Launched the vectorized Turbo acceleration engine, doubling the performance of tpch 1000x.
2. Upgraded version of hstore, called hstore_opt, offers a higher compression ratio and works in conjunction with the Turbo engine to reduce storage space by 40% when compared to column storage.
3. With Flink, you can connect directly to DNs to import data into the database. This results in linear performance improvement in batch data import scenarios. For details, see **Real-Time Binlog Consumption by Flink**.
4. GaussDB(DWS) supports Binlog (currently in beta) and can be used in conjunction with Flink to enable incremental computing. For details, see **Subscribing to Hybrid Data Warehouse Binlog**.
5. This update significantly improves full-column performance while reducing resource consumption.
6. GaussDB(DWS) supports materialized views (currently in beta). For details, see **CREATE MATERIALIZED VIEW**.
7. To improve coarse filtering, the **Varchar/text** column now supports **bitmap index** and **bloom filter**. When creating a table, you must specify them explicitly. For details, see **CREATE TABLE**.
8. To enhance performance in topK and join scenarios, the **runtime filter** feature is now supported. You can learn more about GUC parameters **runtime_filter_type** and **runtime_filter_ratiox** in **Other Optimizer Options**.
9. GaussDB(DWS) supports asynchronous sorting to enhance the **min-max** coarse filtering effect of **PCK** columns.
10. The performance in the **IN** scenario is greatly improved.

11. **ANALYZE** supports incremental merging of partition statistics, collecting only statistics on changed partitions and reusing historical data, which improves execution efficiency. It collects statistics only on predicate columns.
    - The **CREATE TABLE** syntax now includes the **incremental_analyze** parameter to control whether to enable incremental ANALYZE mode for partitioned tables. For details, see **CREATE TABLE**.
    - The **enable_analyze_partition** GUC parameter determines whether to collect statistics on a partition of a table. For details, see **Other Optimizer Options**.
    - The **enable_expr_skew_optimization** GUC parameter controls whether to use expression statistics in the skew optimization policy. For details, see **Optimizer Method Configuration**.
    - **ANALYZE | ANALYSE**
12. GaussDB(DWS) supports large and wide tables, with a maximum of 5,000 columns.
13. **Create index/reindex** supports parallel processing.
14. The **pgxc_get_cstore_dirty_ratio** function is added to obtain the dirty page rate of CU, Delta, and CUDesc in the target table (only **hstore_opt** is supported).

[Convergence and unification]

1. One-click lakehouse: You can use **create external schema** to connect to the HiveMetaStore metadata, avoiding complex **create foreign table** operations and reducing maintenance costs. For details, see **Accessing HiveMetaStore Across Clusters**.
2. GaussDB(DWS) allows for reading and writing in Parquet/ORC format, as well as overwriting, appending, and multi-level partition read and write.
3. GaussDB(DWS) allows for reading in Hudi format.
4. Foreign tables support concurrent execution of **ANALYZE**, significantly improving the precision and speed of statistics collection. However, foreign tables do not support AutoAnalyze capabilities, so it is recommended to manually perform **ANALYZE** after data import.
5. Foreign tables can use the local disk cache for read acceleration.
6. Predicates such as **IN** and **NOT IN** can be pushed down for foreign tables to enhance partition pruning.
7. Foreign tables now support complex types such as map, struct, and array, as well as bytea and blob types.
8. Foreign tables support data masking and row-level access control.
9. GDS now supports the fault tolerance parameter **compatible_illegal_char** for exporting foreign tables.
10. The **read_foreign_table_file** function is added to parse ORC and Parquet files, facilitating fault demarcation.

High availability

1. The fault recovery speed of the unlogged table is greatly improved.

2. Backup sets support cross-version restoration. Fine-grained table-level restoration supports restoration of backup sets generated by clusters of earlier versions (8.1.3 and later versions).
3. Fine-grained table-level restoration supports restoration to a heterogeneous cluster (the number of nodes, DNs, and CNs can be different).
4. Fine-grained restoration supports permissions and comments. Cluster-level and schema-level physical fine-grained backups support backup permissions and comments, as do table-level restorations and schema-level DR.

Space saving

1. Column storage now supports JSONB and JSON types, allowing JSON tables to be created as column-store tables, unlike earlier versions which only supported row-store tables.
2. Hot and cold tables support partition-level **index unusable**, saving local index space for cold partitions.
3. The upgraded **hstore_opt** provides a higher compression ratio and, when used with the Turbo engine, saves 40% more space compared to column storage.

O&M and stability improvement

1. The query filter is enhanced to support interception by SQL feature, type, source, and processed data volume. For details, see **CREATE BLOCK RULE**.
2. GaussDB(DWS) now automatically frees up memory resources by reclaiming idle connections in a timely manner. You can specify the **syscache_clean_policy** parameter to set the policy for clearing the memory and number of idle DN connections. For details, see **Connection Pool Parameters**.
3. The **gs_switch_respool** function is added for dynamic switching of the resource pool used by **queryid** and **threadid**. This enables dynamic adjustment of the resources used by SQL. For details, see **Resource Management Functions**.
4. The **pg_sequences** view is added to display the attributes of sequences accessible to the current user.
5. The following functions are added to allow you to query information about all chunks requested by the memory in a specified shared memory:
   - **pg_shared_chunk_detail**
   - **pv_session_chunk_detail**
   - **pg_shared_chunk_dump**
   - **pv_session_chunk_dump**
6. The **pgxc_query_resource_info** function is added to display the resource usage of the SQL statement corresponding to a specified query ID on all DNs. For details, see **pgxc_query_resource_info**.
7. The **pgxc_stat_get_last_data_access_timestamp** function is added to return the last access time of a table. This helps the service to identify and clear tables that have not been accessed for a long time. For details, see **pgxc_stat_get_last_data_access_timestamp**.
8. SQL hints support more hints that provide better control over the generation of execution plans. For details, see **Configuration Parameter Hints**.

9. Performance fields are added to top SQL statements that are related to syntax parsing and disk cache. This makes it easier to identify performance issues. For details, see **Real-Time Top SQL**.
10. The preset data masking administrator has the authority to create, modify, and delete data masking policies.
11. Audit logs can record objects that are deleted in cascading mode.
12. Audit logs can be dumped to OBS.

Ecosystem compatibility

1. **if not exists** can be included in the **create schema**, **create index**, and **create sequence** statements.
2. The **merge into** statement now allows for specified partitions to be merged. For details, see **MERGE INTO**.
3. In Teradata-compatible mode, trailing spaces in strings can be ignored when comparing them.
4. GUC parameters can be used to determine if the **n** in **varchar(n)** will be automatically converted to **nvarchar2**.
5. PostGIS has been upgraded to version 3.2.2.

Restrictions

1. A maximum of 256 VWs are supported, each with 1,024 DNs. It is recommended to have no more than 32 VWs and 128 DNs.
2. DR is not supported by OBS tables that have decoupled storage and compute. Only full backup and restoration are available.

Behavior changes

1. **VACUUM FULL**, **ANALYZE**, and **CLUSTER** are only supported for individual tables, not the entire database. Even though there are no syntax errors, the commands will not be executed.
2. OBS tables with decoupled storage and compute do not support delta tables. If **enable_delta** is set to **on**, no error is reported, but delta tables do not take effect. If a delta table is required, use the hstore-opt table instead.
3. By default, NUMA core binding is enabled and can be turned off dynamically using the **enable_numa_bind** parameter.
4. Upgrading from version 8.3.0 Turbo to version 910 changes the numeric(38) data type in Turbo tables to numeric(39), without affecting display width. Rolling back to the previous version will not reverse this change.
5. Due to the decoupling of storage and compute, the EVS storage space in DWS 3.0 is half that of DWS 2.0 by default. For example, purchasing 1 TB of EVS storage provides 500 GB in DWS 3.0 for active/standby mode, compared to 1 TB in DWS 2.0. When migrating data from DWS 2.0 to DWS 3.0, the EVS storage space required in DWS 3.0 is twice that of DWS 2.0.

1.3 Version 8.1.3

1.3.1 New Features in 8.1.3

For details about new features in 8.1.3.*x*, see **New features**. For details about resolved issues in each patch, see **1.3.2 New Features and Resolved Issues in 8.1.3.x**.

[Release date of V8.1.3.336]: October 15, 2024

[Release date of V8.1.3.333]: June 30, 2024

[Release date of V8.1.3.330]: March 16, 2024

[Release date of V8.1.3.325]: November 2, 2023

[Release date of V8.1.3.323]: October 16, 2023

[Release date of V8.1.3.322]: August 4, 2023

[Release date of V8.1.3.321]: June 26, 2023

[Release date of V8.1.3.320]: May 19, 2023

[Release date of V8.1.3.310]: March 9, 2023

[Release date of V8.1.3.300]: December 19, 2022

[Release date of V8.1.3.200]: October 31, 2022

[Release date of V8.1.3.110]: August 23, 2022

[Release date of V8.1.3.100]: June 20, 2022

[Release date of V8.1.3]: April 15, 2022

New features

Table 1-2 New functions in version 8.1.3

Feature	Description	Reference
Partition addition and partition table management are supported.	PERIOD (interval type) and TTL (interval type) are now available in partition management.	**CREATE TABLE** **ALTER TABLE** **CREATE TABLE PARTITION**
Support for foreign tables in JSON format	1. READ ONLY HDFS foreign tables in JSON format are supported. 2. READ ONLY OBS foreign tables in JSON file format are supported.	**CREATE FOREIGN TABLE (SQL on Hadoop or OBS)**

Feature	Description	Reference
Cross-Cluster interconnection	1. Constraints are removed: a. The hang constraint of GDS is removed. b. The constraints on common aggregation functions, such as **sum**, **count**, **min**, **max**, and **avg** are removed. c. The constraints on scalar functions and analytical functions are removed. d. The strong verification of the column names and column types of foreign tables and source tables is added. e. The constraint that the column name cannot contain **WHERE** is removed. f. The limit constraint is removed. g. The temporary GDS foreign table policy is improved. 2. If the local cluster is the destination cluster, you can run the following statements:	**GDS-based Cross-Cluster Interconnection**
Enhanced cold and hot table functions	Automatic migration of cold and hot tables	**CREATE TABLE**
The row-store ring buffer is controlled by a switch.	The ring buffer is controlled by a switch and its threshold is adjustable. Batch update of large tables no longer uses the ring buffer.	**buffer_ring_ratio**

Feature	Description	Reference
GDS supports the euro sign.	The GBK character set supports the euro sign.	**CREATE DATABASE**
OBS foreign tables support XSKY S3.	OBS foreign tables are adapted to XSKY and the parameter **eol** is added.	**CREATE FOREIGN TABLE (SQL on Hadoop or OBS)**
SQL supports Roaring Bitmaps.	The RoaringBitmap function is supported to better support common customer profile services of Internet services.	**Bitmap Functions and Operators** **RoaringBitmap**
Case-insensitive is supported to improve Teradata compatibility.	When migrating data from Teradata to GaussDB(DWS), there is a lot of duplicate data in the source data with different letter cases. If GaussDB(DWS) removes duplicates using the **distinct** syntax, there will still be a significant amount of duplicate data remaining. Using the **upper** function to deduplicate the data will change the source data and require complex procedures and logic. To make things easier and reduce workload, GaussDB(DWS) now has a case-insensitive feature.	**Collation Support** **Collation Version Function**

Feature	Description	Reference
List partitioning	List partitioned tables are supported.	• Syntax: **CREATE TABLE PARTITION** **ALTER TABLE PARTITION** • System catalog: **PG_PARTITION** • Views: **DBA_PART_INDEXES** **DBA_PART_TABLES** **DBA_TAB_PARTITIONS** **USER_IND_PARTITIONS** **USER_PART_INDEXES** **USER_TAB_PARTITIONS**
Enhanced MySQL compatibility	**ALTER TABLE** can modify multiple columns at a time. **ALTER TABLE** supports **COMMENT**. **ALTER TABLE** supports **CHANGE**, **DROP KEY**, **DROP PARTITION**, and **FIRST**/**AFTER**.	**ALTER INDEX**, **CREATE INDEX** **ALTER TABLE**, **CREATE TABLE** **ALTER TABLE PARTITION**
Projection pushdown	Unnecessary columns in a multi-column view are automatically deleted during reference to avoid redundant calculation.	Added the description for **projection pushdown** to **rewrite_rule**.
Share scan	Share scan	Stream plan CTEs support share scan. Added **enable_stream_ctescan**. The value **STREAM_CTESCAN** is added to **logging_module**. The optional **[NOT] MATERIALIZED** is added to the **WITH** clause in the **SELECT** syntax.

Feature	Description	Reference
Bloom Filter for column-store tables	In a HASH JOIN, if the thread of the foreign table contains HDFS tables or column-store tables, the Bloom filter is triggered.	enable_bloom_filter
Column-store replication tables support **UPDATE**.	Replicated tables support **UPDATE**, **DELETE**, and **MERGE INTO** operations.	MERGE INTO UPDATE UPSERT
Fine-grained permission management	1. Added the **ALTER**, **DROP** and **VACUUM** permissions at table level. 2. Added the **ALTER** and **DROP** permissions at schema level. 3. Add the preset roles **role_signal_backend** and **role_read_all_stats**.	• Preset Roles • Added permissions to tables: VACUUM ALTER TABLE DROP TABLE • Added permissions to schemas: ALTER SCHEMA DROP SCHEMA ALTER DEFAULT PRIVILEGES • GRANT • REVOKE
The problem of the **INSERT OVERWRITE** deadlock on multiple CNs is fixed.	No deadlock occurs when **INSERT OVERWRITE** is triggered on multiple CNs at the same time.	-

Feature	Description	Reference
Execution plan optimization	• If the join conditions contain **OR** and the execution plan uses nestloop, the performance is poor. Therefore, the statement is changed to **UNION ALL**. • To join column-store tables, if the join or filter conditions contain **OR**, the **OR** conditions are pruned before join. • When large and small tables are joined across many DNs, the small table is broadcast instead of being redistributed.	**Adjusting Key Parameters During SQL Tuning** Added **projection_pushdown** and **or_conversion** to **rewrite_rule**.
Relfile-based space statistics and space control	1. The query results of the **pg_table_size**, **pg_relation_size** and **table_skewness** views can be returned in seconds. 2. Schema space control can collect statistics on the full space and the constraints are removed. 3. The user/schema space calibration functions can be quickly executed, and the schema space calibration function can be automatically executed. 4. The SQL interface allocates space quota based on the total schema space instead of the DN level.	• **Workspace Management** • Added the following GUC parameters for load management: **space_once_adjust_num** **space_readjust_schedule** • Added the system catalog: **PG_RELFILENODE_SIZE** • Added functions: **gs_table_distribution(schemaname text, tablename text)** **gs_table_distribution()** **pgxc_wlm_readjust_relfilenode_size_table()** **pgxc_wlm_readjust_relfilenode_size_table(integer)**

Feature	Description	Reference
Enhanced performance fault locating and demarcation	1. Enhanced communication exception monitoring logs 2. Enhanced **pgxc_stat_activity** view 3. Top SQL statements can be associated with unique SQL statements. 4. Added the distributed view **pg_session_wlmstat**.	• Added the system view **PG_COMM_QUERY_SPEED**. • Added the description for the **lwtid** and **stmt_type** columns of **PG_STAT_ACTIVITY**. • Added the **unique_sql_id** column information to **GS_WLM_SESSION_HISTORY**. • Added the system view **PGXC_SESSION_WLMSTAT**.
Resource load management optimization and reconstruction	1. Enhanced user resource monitoring: The user resource monitoring logic is modified. 2. Enhanced resource monitoring: Job and user resource monitoring is optimized, and queue-level resource monitoring is added.	• **User Resource Monitoring** • Enhanced resource monitoring: – Added: **Resource Pool Monitoring**. – Added system views: **PGXC_RESPOOL_RESOURCE_INFO** **PGXC_RESPOOL_RUNTIME_INFO** **PGXC_RESPOOL_RESOURCE_HISTORY** **GS_RESPOOL_RESOURCE_INFO** **GS_RESPOOL_RUNTIME_INFO** – Added the system catalog: **GS_RESPOOL_RESOURCE_HISTORY**

Feature	Description	Reference
Modified partition table features	1. Changed the limit on the number of boundary values: The number of partitions in a partition table cannot exceed 32767, and the number of boundary values of all partitions cannot exceed 32767. 2. The default partition creation policy is modified. When a partition table is created, two default partitions are created. The partition time range of the two default partitions is **PERIOD**.	**CREATE TABLE PARTITION**
Redistribution column hints are supported in the AGG process.	During data migration from Oracle data warehouses, you can manually specify the distribution column using enhanced hints.	**Plan Hint Optimization** **Stream Operation Hints**
DDL lock timeout configuration (added in 8.1.3.110)	To specify whether to report an error when the divisor is 0 in MySQL compatibility mode, the compatibility configuration item **enable_division_by_zero_mysql** is added to the **behavior_compat_options** parameter.	**behavior_compat_options**
DDL lock timeout configuration (added in 8.1.3.200)	Added the GUC parameter **ddl_lock_timeout**, which specifies the DDL lock timeout interval.	**ddl_lock_timeout**

Feature	Description	Reference
Enhanced the view **PG_LOCKS**. (added in 8.1.3.200)	• Added the views **PGXC_WAIT_DETAIL** and **PGXC_LOCKWAIT_DETAIL**. • Add columns such as **wait_on_pid** and **query_id**.	• **PGXC_WAIT_DETAIL** • **PGXC_LOCKWAIT_DETAIL**
Data masking compatibility configuration (added in 8.1.3.310)	The GUC parameter **redact_compat_options** is added to configure the compatibility of the data masking techniques.	• **redact_compat_options**

Feature	Description	Reference
Concurrent truncate, exchange, and select operations (added in 8.1.3.320)	Added the GUC parameter **ddl_select_concurrent_mode**. This parameter is used to solve the problem that the query statement lasts for a long time and blocks DDL in the scenario where the data volume is large or the query is complex. The effect is the same as that of the Oracle database. Application scenarios: • Concurrent truncate and select operations • Concurrent exchange and select operations Scenario constraints: • Concurrency is not supported when there are conflicts with locks of higher levels (higher than level 1). For example, **autoanalyze** is triggered by **select** when **autoanalyze_mode** is set to **normal**. • Concurrency is not supported when there are conflicts with locks in transaction blocks. Connection constraints: • When the JDBC, ODBC, or Python driver is used, if **autocommit** is set to **false**, this feature is not supported. • This feature is not supported by query statements delivered by Data Studio and	ddl_select_concurrent_mode

Feature	Description	Reference
	auto-committed transactions.	
Enabling of the early stop optimization for Limit statements (added in 8.1.3.320)	Added the GUC parameter **enable_limit_stop** to specify whether to enable the early stop optimization for LIMIT statements.	**enable_limit_stop**
Early stop behavior change (added in 8.1.3.322)	The default value of the GUC parameter **enable_limit_stop** is changed to **on**.	**enable_limit_stop**
normalize_negative_zero (added in 8.1.3.333)	The **behavior_compat_options** parameter now includes the **normalize_negative_zero** option, which determines whether the **ceil()** and **round()** functions will return **-0** for a given float value.	**behavior_compat_options** ("Developer Guide > GUC Parameters > Miscellaneous Parameters")
internal_compat_options (added in 8.1.3.333)	A new GUC parameter **internal_compat_options** has been added to allow for configuration of the database compatibility behavior. The **light_proxy_permission_compat** option is used to configure the nested query permission in the light proxy scenario.	"GUC Parameters" > "Miscellaneous Parameters" in the *Developer Guide*
disable_client_detection_commit (added in 8.1.3.333)	The **behavior_compat_options** parameter now includes the **disable_client_detection_commit** option, which determines whether the connection to the client is checked before committing each transaction.	**behavior_compat_options** ("Developer Guide > GUC Parameters > Miscellaneous Parameters")

Feature	Description	Reference
enable_stream_ctescan (Disabled by default for new installation) (modified in 8.1.3.333)	Modified the **enable_stream_ctescan** parameter. This parameter is forward-compatible after an upgrade and is disabled by default upon new installation.	"GUC Parameters" > "Optimizer Method Configuration" in *Developer Guide*
enable_trunc_orc_string (added in 8.1.3.336)	Controls the foreign table query behavior when the foreign table field is in ORC format and the data type is varchar(n), but the field type in the ORC file is string and the length of the string exceeds n.	**behavior_compat_options** ("Developer Guide > GUC Parameters > Miscellaneous Parameters")
gds_fill_multi_missing_fields (added in 8.1.3.336)	gds_fill_multi_missing_fields Controls the behavior when the GDS foreign table fault tolerance parameter **fill_missing_fields** is set to **true** or **on**.	**behavior_compat_options** ("Developer Guide > GUC Parameters > Miscellaneous Parameters")

SQL Syntax

Table 1-3 SQL syntax

Change Type	No.	Name	Change Description
Added	1	CREATE FOREIGN TABLE (SQL on Hadoop or OBS)	Added **json** for the parameter **Format** of **OPTION**.
	2	CREATE FOREIGN TABLE (SQL on Hadoop or OBS)	Added **force_mapping** for **OPTION**.
	3	Column type **kvtype**	Specifies the column type of time series tables in the **CREATE TABLE** and **ALTER COLUMN** syntax.
	4	Table-level parameter: **sub_partition_count**	Configures the number of level-2 partitions in a time sequence table.

Change Type	No.	Name	Change Description
	5	Table-level parameter **ttl**	Specifies the expiration time of auto-added partitions.
	6	Table-level parameter **period**	Specifies the interval for triggering partition adding and dropping tasks and the time range of a single partition.
	7	List partitioning support	The list partition operation syntax is added, including the **CREATE** and **ALTER** operations. The **CREATE** syntax is a distinct branch of syntax. In the **AT** syntax, all syntax, except for **SPLIT**, is similar to range partitioning.
	8	ALTER TABLE ADD INDEX/ DROP INDEX	The **ALTER TABLE** syntax branch is added to add and delete indexes.
	9	CREATE TABLE ... LIKE	The **CREATE TABLE... LIKE** syntax without brackets is added.
	10	ALTER TABLE ... ADD/ MODIFY COLUMN	The statements for adding and modifying columns are added to **ALTER TABLE**. **COMMENT** and **DEFAULT** can be set.
	11	Added the **[NOT] MATERIALIZED** syntax after **with cte as**.	Added the **[NOT] MATERIALIZED** syntax after **with cte as**.
	12	alter index ... comment	The **COMMENT** clause is now available in the **ALTER INDEX** syntax.
	13	ALTER TABLE ... add index comment	The **COMMENT** clause is now available in the **alter table add index** syntax.
	14	create index index_name on table_name comment	The **COMMENT** clause is now available in the **CREATE INDEX** syntax.
	15	copy to	Added **server**, **bom**, **fileprefix**, and **maxrow** to the **OPTION** of the **COPY TO** statement.

Change Type	No.	Name	Change Description
	16	CREATE FOREIGN TABLE (OBS import and export)	Added **bom** to the **OPTION** of the **CREATE FOREIGN TABLE** statement (OBS import and export).
	17	Operator =	If two Roaring Bitmaps are equal, **true** is returned. Otherwise, **false** is returned.
	18	Operator <>	If two Roaring Bitmaps are not equal, **true** is returned. Otherwise, **false** is returned.
	19	Operator &	Calculates the intersection of two Roaring Bitmaps.
	20	Operator |	Calculates the union of two Roaring Bitmaps.
	21	Operator |	Calculates the result of adding an ID to a Roaring Bitmap.
	22	Operator #	Calculates the XOR result of two Roaring Bitmaps.
	23	Operator -	Obtains the set of elements that are in a Roaring Bitmap but not in another Roaring Bitmap.
	24	Operator -	Removes a specified ID from a Roaring Bitmap.
	25	Operator @>	If the Roaring Bitmap before the operator contains the elements after the operator, **true** is returned. Otherwise, **false** is returned.
	26	Operator <@	If the Roaring Bitmap after the operator contains the elements before the operator, **true** is returned. Otherwise, **false** is returned.
	27	Operator &&	If two Roaring Bitmaps overlap, **true** is returned. Otherwise, **false** is returned.
	28	ALTER TABLE DROP KEY	Added the syntax for deleting indexes. The usage of this syntax is the same as that of **ALTER TABLE DROP INDEX**.

Change Type	No.	Name	Change Description
	29	ALTER TABLE CHANGE	Compatible with the **CHANGE** syntax in MySQL. Column names and column attributes can be modified at the same time.
	30	ALTER TABLE ... FIRST/ AFTER colname	The syntax layer supports the **FIRST**/**AFTER** syntax, but does not implement the actual semantics. It is applicable to the **ALTER TABLE ADD**/ **MODIFY**/**CHANGE COLUMN** scenario and is controlled by the parameter **skip_first_after_mysql**.
	31	AGG HINT	Added Agg hints for performance optimization.
	32	ALTER TABLE ... ALTER COLUMN cstore_cu_sample_ratio	To reduce the work of CU decompression, samples are concentrated in randomly selected CUs. Therefore, it is difficult to obtain data features. This field attribute is used to select more CUs without increasing the sampling ratio to facilitate data feature obtaining.
Modified	33	Table-level parameter **deltarow_threshold**	The default value of **deltarow_threshold** is set to **10000**, which specifies the upper limit of rows when column-store tables are imported to the Delta table. This parameter is valid only when the table-level parameter **enable_delta** is enabled.

Change Type	No.	Name	Change Description
	34	More data types are supported by Btree indexes.	The data types supported by the B-tree indexes are extended to support row store tables, column-store tables, and time series tables. btree_gin provides data types int2, int4, int8, float4, float8, timestamp with time zone, timestamp without time zone, time with time zone, time without time zone, date, interval, oid, money, "char", varchar, text, bytea, bit, varbit, macaddr, macaddr8, inet, cidr, uuid, name, bool, bpchar, and all enum types.
	35	**GRANT**/**REVOKE**/**ALTER DEFAULT PRIVILEGES**	The ALTER/DROP/VACUUM permissions are added.
	36	**ALTER TABLE ... DROP PARTITION**	The **DROP PARTITION** syntax can be used to delete multiple partitions.
	37	**DEFAULT** clause in the **CREATE**/**ALTER TABLE** statement	The **DEFAULT** clause in the **CREATE**/**ALTER TABLE** statement does not support suffix operators (currently, only the factorial suffix operator "!" is used). For example, create table t (a int default 3!) is not allowed.

Keywords

Table 1-4 Keywords

Change Type	No.	Name	Change Description
Added	1	MATERIALIZED	Added the **[NOT] MATERIALIZED** syntax after **with cte as**. As a non-reserved keyword, it can be still used as an object name. When it is used as a column alias, **AS** must be added.

Change Type	No.	Name	Change Description
	2	time_fill	It is used as the keyword of a time filling expression to output the **time_fill** column. It cannot be used as a function name or user-defined data type name.
	3	fill_first/fill_last/fill_avg	It is used as the keyword of a time filling expression to output the filled column. It cannot be used as a function name or user-defined data type name.
	4	list	Specifies the type of a partitioned table. As a non-reserved keyword, it can still be used as an object name. When it is used as a column alias, **AS** must be added.
	5	tsfield/tstag/tstime	Specifies the type of a partitioned table. As a non-reserved keyword, it can still be used as an object name. When it is used as a column alias, **AS** must be added.

System Catalogs

Table 1-5 System catalogs

Change Type	No.	Name	Change Description
Added	1	rb_added	A value is added to RoaringBitmap.
	2	pg_partition	Added the **boundexprs** column to **pg_partition**.
	3	pg_relfilenode_size	New system catalog
	4	pg_attribute	The **attkvtype** column is added to **pg_attribute** to record the **kvtype** of columns.

Change Type	No.	Name	Change Description
	5	pg_collation	The **case_insensitive** record is added to support case-insensitive behaviors.

System Functions

Table 1-6 System functions

Change Type	No.	Name	Change Description
Added	1	rb_build	Converts an int array into a bitmap.
	2	rb_to_array	Reverse operation of **rb_build**. It converts a Roaring Bitmap into an int array.
	3	rb_and	Obtains the intersection of two Roaring Bitmaps.
	4	rb_or	Obtains the union of two Roaring Bitmaps.
	5	rb_xor	Obtains the XOR result of two Roaring Bitmaps.
	6	rb_andnot	Performs AND then negation operation on two Roaring Bitmaps.
	7	rb_cardinality	Calculates the cardinality of a Roaring Bitmap.
	8	rb_and_cardinality	Calculates the cardinality of the And result of two Roaring Bitmaps.
	9	rb_or_cardinality	Calculates the cardinality of the OR result of two Roaring Bitmaps.
	10	rb_xor_cardinality	Calculates the cardinality of the XOR result of two Roaring Bitmaps.
	11	rb_andnot_cardinality	Calculates the cardinality of the andNot result of two Roaring Bitmaps.

Change Type	No.	Name	Change Description
	12	rb_is_empty	Determines whether a Roaring Bitmap is empty.
	13	rb_equals	Determines whether two Roaring Bitmaps are equal.
	14	rb_intersect	Determines whether two Roaring Bitmaps intersect.
	15	rb_contain	Determines whether the first Roaring Bitmap contains a specified value.
	16	rb_add	Adds a value to a Roaring Bitmap.
	17	rb_remove	Deletes a value from a Roaring Bitmap.
	18	rb_flip	Reverses the Roaring Bitmap within a specified range.
	19	rb_min	Obtains the minimum value of a Roaring Bitmap.
	20	rb_max	Obtains the maximum value of a Roaring Bitmap.
	21	rb_rank	Returns the cardinality of values in a bitmap that are less than or equal to the specified Offset.
	22	rb_contain_rb	Check whether the first Roaring Bitmap contains the second Roaring Bitmap.
	23	rb_containedby_rb	Check whether the second Roaring Bitmap contains the first Roaring Bitmap.
	24	rb_containedby	Determines whether a specified value is included in a specified Roaring Bitmap.
	25	rb_iterate	Returns the ints corresponding to a Roaring Bitmap.
	26	rb_and_agg	Aggregates a Roaring Bitmap column based on the AND logic.
	27	rb_or_agg	Aggregates a Roaring Bitmap column based on the OR logic.

Change Type	No.	Name	Change Description
	28	rb_xor_agg	Aggregates a Roaring Bitmap column based on the XOR logic.
	29	rb_and_cardinality_agg	Obtains the cardinality of the AND result of a Roaring Bitmap column.
	30	rb_or_cardinality_agg	Obtains the cardinality of the OR result of a Roaring Bitmap column.
	31	rb_xor_cardinality_agg	Obtains the cardinality of the XOR result of a Roaring Bitmap column.
	32	rb_build_agg	Aggregates the int column into RoaringBitmap data.
	33	pgxc_wlm_readjust_relfilenode_size_table()	Space statistics calibration function. It does not recreate the **PG_RELFILENODE_SIZE** system catalog but re-calibrates the user and schema space.
	34	gs_table_distribution()	Quickly queries a table size.
	35	pg_obs_cold_refresh_time	Modifies the time for automatic switchover of OBS multi-temperature tables.
	36	gs_clean_tag_relation	Deletes the useless data in the tagid row of the tag table. The input parameter of the function is the OID of the time series table. Each partition traverses the minimum value of the tagid column in the **cudesc** table to obtain the minimum tagid value in the entire time series table.
	37	proc_drop_partition	Drops a partition whose boundary time exceeds the TTL.
	38	proc_add_partition	Creates partitions for a partitioned table.
	39	pg_collation_actual_version	Returns the actual version number of an ICU collation.

Change Type	No.	Name	Change Description
	40	first	Indicates the first element in a group.
	41	last	Indicates the last element in a group.
	42	mode	Indicates the value with the highest occurrence frequency in a group.
	43	delta	Indicates the difference between two adjacent rows.
	44	percentile_of_value	Indicates the approximate percentile value.
	45	value_of_percentile	Indicates the approximate percentile.
	46	spread	Indicates the difference between the maximum value and minimum value in a group.
	47	pg_flush_buffers	Flushes all row-store dirty pages.
Modified	48	pg_stat_activity series views	The **stmt_type** and **lwtid** columns are added to the **pg_stat_get_activity_with_conninfo**, **pg_stat_activity**, **pgxc_stat_activity** and **pg_stat_get_activity** views.
	49	Added two rows to the **pg_authid** system catalog.	Added the preset roles **pg_role_signal_backend** and **pg_role_read_all_stats**.
	50	vac_fileclear_relation	Returns the number of files to be cleared in a specified table. If no files are to be cleared, 0 is returned.
	51	vac_fileclear_all_relation	Returns the number of files to be cleared in all column store tables. If no files are to be cleared, 0 is returned.

System Views

Table 1-7 System views

Change Type	No.	Name	Change Description
Added	1	pgxc_session_wlmstat	New view
	2	pg_comm_query_speed	New view. It is used to query sending information based on query_ids.
	3	pgxc_respool_resource_info pgxc_respool_runtime_info pgxc_respool_resource_history gs_respool_resource_info gs_respool_runtime_info	New views related to resource monitoring.
	4	pgxc_wait_detail pgxc_lockwait_detail	Added the enhanced view **pg_locks**.
Modified	5	DBA_PART_INDEXES DBA_PART_TABLES DBA_TAB_PARTITIONS USER_IND_PARTITIONS USER_PART_INDEXES USER_TAB_PARTITIONS	Added description for list partitions.
	6	pgxc_wlm_session_statistics	The logic for querying real-time information about Top SQL statements from all CNs is changed from serial to parallel to improve performance. The function remains unchanged.
	7	all_indexes	The definition of the view **all_indexes** in **sys** and **pg_catalog** is incorrect. If objects with the same name exist in different schemas, the result set expands.

Behavior Changes

Table 1-8 Behavior changes

Change Type	No.	Name	Change Description
Modified	1	In **CREATE INDEX**, the target table is a time series table.	Any index created in the time series table is converted to a double index in the tag table. The index column of the double index is the specified column that the index is created for.
	2	Secondary load management	Added secondary management to load management. Functions and multi-statements that contain complex queries may trigger multiple controls. You can set **enable_transaction_parctl** to **off** to disable secondary management. If you do so, transaction block statements and multi-statement management will also be disabled.
	3	Load management (autoanalyze management)	The control logic for queries triggering autoanalyze is changed from **no control** to **control**. You can set **enable_transaction_parctl=off** to disable the autoanalyze control.
	4	User monitoring view **pg_total_user_resource_info**	1. Changed the CPU and memory resource usage and limit to the resource usage and limit in the cluster. 2. The monitored CPU, I/O, and memory objects are changed from complex jobs to all jobs. 3. The CPU monitoring logic is changed from Cgroup monitoring to job CPU monitoring summary.

Change Type	No.	Name	Change Description
	5	Audit logs	1. Statements in a transaction are audited when the statement type is set to be audited, even if the transaction is not set to be audited. 2. The **DECLARE CURSOR** statement is audited when the GUC parameter **audit_operation_exec** is set to **select**.

GUC Parameters

Table 1-9 GUC parameters

Change Type	No.	Name	Change Description
Added	1	space_readjust_schedule	Indicates whether to enable automatic calibration for users and schema spaces. The options are **off**, **auto**, and **auto** (*xxx* K/M/G). The default value is **auto**.
	2	space_once_adjust_num	Threshold of the number of files processed each time during slow build and fine-grained calibration in the space management and statistics functions. The default value is **300**.
	3	tag_cache_max_number	Indicates the maximum number of items cached in the tag cache of a global hash table. The default value is **10000000**.
	4	enable_tagbucket_auto_adapt	Indicates whether to enable tagbucket adaptive adjustment. The default value is **on**.
	5	cache_tag_value_num	Number of cached tag tuples during tag column lateread. The default value is **60000**.

Change Type	No.	Name	Change Description
	6	buffer_ring_ratio	Controls the threshold and switch of the ring buffer in a row-store table. The default value is **250**, that is, 1/4 (250/1000), which is the same as the previous logic.
	7	enable_stream_ctescan	This parameter is added. By default, this parameter is set to **OFF** after an upgrade and is set to **ON** after a new installation. Specifies whether to enable the **share scan** function for the stream plan.
	8	behavior_compat_options	The **disable_including_all_mysql** option is added to control whether the **CREATE TABLE LIKE** syntax is in **INCLUDING ALL** mode. By default, this option is not set and the **CREATE TABLE LIKE** syntax is in **INCLUDING ALL** mode.
	9	profile_logging_module	The GUC parameter **profile_logging_module** is added to configure the type of performance logs to be recorded. By default, OBS, HADOOP, and REMOTE_DATANODE are enabled, and MD is disabled for both upgrade and new installation. The method of setting this parameter is the same as that of setting **logging_module**.
	10	object_mtime_record_mode	Controls the behaviors of **pg_object** recording modification time. By default, the behavior of the old version is retained. The new option can be set to not record the TRUNCATE/GRANT/REVOKE operations on partitions.
	11	skew_option	Specifies whether to enable an optimization policy.

Change Type	No.	Name	Change Description
	12	ddl_lock_timeout	DDL lock timeout interval.
Modified	13	rewrite_rule	• The **orconversion** option is added and is enabled by default. Indicates the OR optimization rules for equi-join. Change: The query plan converts nestloop to hashjoin. • The **projection_pushdown** option is added and is enabled by default. Change: Unused columns in subqueries, CTEs, and views are deleted.
	14	max_process_memory	It is an OM setting item configured during initial installation. The original formula is: Available memory x 0.7/(1 + Number of DNs). The coefficient 0.7 is changed to 0.8. It remains unchanged in scenarios such as upgrade and scale-out of the old cluster.
	15	enable_bloom_filter	Reused parameter. It is now used to control BloomFilter in a column-store table. The default value remains unchanged (**Enabled**).
	16	retry_ecode_list	Added the default value **45003** to solve the problem that wrong partitions may be queried when partitions are added and queried concurrently in a list partitioned table.
	17	auth_iteration_count	The default value is reduced from **50000** to **10000**. The change applies to both installation and upgrade. Indicates the number of hash iterations of the passwords of the client and server.

1.3.2 New Features and Resolved Issues in 8.1.3.x

8.1.3.336

Table 1-10 New features/Resolved issues in version 8.1.3.336

Category	Feature or Resolved Issue	Cause	Version	Handling Method
New features	None	-	-	-
Resolved issues	The error message " value too long for type character varying(512)" is displayed during foreign table import.	If the type of the ORC foreign table does not match the corresponding field type in the file (e.g., varchar (y) vs. string), an error will be reported during the import process due to the field length exceeding the limit.	8.1.1.100	Upgrade the version to 8.1.3.336 or later.
	Changes in OpenSSL affect the scheduler, causing errors during installation, scale-out, and scheduler functions.	OpenSSL changes the sequence of **LD_LIBRARY_PATH**, placing the system directory before the GAUSS directory, leading to incorrect **.so** files being found and startup failures.	Versions earlier than 8.1.3.336	

8.1.3.333

Table 1-11 New features/Resolved issues in version 8.1.3.333

Category	Feature or Resolved Issue	Cause	Version	Handling Method
New features	None	-	-	-
Resolved issues	Permissions are lost after a cluster upgrade.	Upon upgrading to version 8.1.3.330, an error message appears indicating insufficient permission for certain link services. An earlier version contains a vulnerability that allows improper permission bypass. Upgrading to a version that addresses this issue results in a change in behavior.	8.1.3.330	Upgrade the version to 8.1.3.333 or later.
	The **ceil** function's output of **-0** affects service judgment.	The **ceil** function may return **-0** when rounding a float value. Use the **normalize_negative_zero** parameter to control whether **-0** is returned.	Versions earlier than 8.1.3.333	
	The sqlbuil fuzzing test causes a core dump "(ctePlan != __null && ctePlan->isCtePlan&&InitStreamFlow" in complex queries.	During the **finalize_node_id** phase, **initplan** is copied, and the sequence of **glob->subplans** is adjusted. However, the position of the **CTE** pointed to by **referencedCtePlanIds** is not adjusted, causing the **CTE** to point to an incorrect subplan and be set to NULL.	Versions earlier than 8.1.3.333	

Category	Feature or Resolved Issue	Cause	Version	Handling Method
	In GaussDB(DWS), queries using the decimal data type in Hive display null values.	GaussDB(DWS) and Hive process decimal data differently.	Versions earlier than 8.1.3.333	
	The **WITH RECURSIVE** statement runs indefinitely.	In the Arm environment, thread information synchronization is abnormal during the **WITH RECURSIVE** statement execution, causing variables to not update synchronously.	8.1.3.323	

8.1.3.330

Table 1-12 New features/Resolved issues in version 8.1.3.330

Type	Feature or Resolved Issue	Cause	Version	Handling Method
New features	None	-	-	-
Resolved issues	Core dump during plan generation for **insert into select** statement.	Duplicate sublinks in ORCLAUSE conversion lead to double adjustment in OffsetVarNodes.	Versions earlier than 8.1.3.330	Upgrade the version to 8.1.3.330 or later.

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	Accidental core dump "core:CStorePartitionInsert::findBiggestPartition" during column storage lightweight test.	During statistics collection for **bulkloadUsedMemSize** in a partitioned table using column-store, both **UPDATE** and **INSERT** operators are gathered by the system. However, the adaptive memory size is calculated separately for each operator when data is flushed to disks, which can result in **g_bulkloadUsedMemSize** being higher than expected. If the memory usage of the **UPDATE** operator reaches the estimated threshold, it could prevent an **INSERT** operator data record from being inserted.	Versions earlier than 8.1.3.330	
	Wait ccn queuing without reaching threshold.	Inability to calibrate global memory during CCN queuing blocks jobs.	Versions earlier than 8.1.3.330	

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	Unauthorized table queries possible through nesting.	The light proxy's permission check relies on the **ExecCheckRTPerms** function within the CN's checkLightQuery procedure. This check is not extended to DNs. For **ExecCheckRTPerms** to operate correctly, the **rangeTables** parameter should be set to **RTE_RELATION**. If not, the function defaults to returning **true**. However, this mechanism fails for nested SQL statements, where the type changes to **RTE_SUBQUERY**, skipping the necessary permission validation.	Versions earlier than 8.1.3.330	
	Occasional "canceling statement due to statement timeout" error with deletion statement.	The transaction time is not reset for the w packet, leading to thread reuse.	Versions earlier than 8.1.3.330	
	Memory leak when querying JSON type data.	Memory is not released in the jsonb **out** function, causing high usage.	Versions earlier than 8.1.3.330	

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	"Tuple concurrently updated" error during concurrent job execution.	The OID of a partition is identical to that of its corresponding table. During the execution of the ANALYZE command, the **pg_object** catalog is updated with the OID of the partition. This update process also applies to the **pg_object** record of the table itself. Concurrently, DDL operations may be executed. For instance, if an ALTER TABLE command is executed, it will modify the **pg_object** record of the table, which could potentially result in an error.	Versions earlier than 8.1.3.330	

8.1.3.325

Table 1-13 New features/Resolved issues in version 8.1.3.325

Type	Feature or Resolved Issue	Cause	Version	Handling Method
New features	• The GB18030_2022 character encoding is supported. • The subquery hint function can be disabled. • The GDS foreign table is compatible with invalid UTF-8 characters.	-	-	-
Resolved issues	Logs fail and the cluster is hung after DN restart.	When the stream thread error logs are printed, the stream thread responds to the cancel signal. When the logs are printed again, the stream thread is hung up.	8.1.3.320	Upgrade the version to 8.1.3.325.
	• When a service table is created, the following error message is occasionally displayed: **relation "xxx" already exists**. • The error **could not read block xxx in file "xxx"** is occasionally reported.	When the OID usage surpasses 4.2 billion, the system reallocates OIDs. During this reallocation process, intermittent errors may occur.	8.1.3.323 and earlier versions	

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	Checkpoint failures on the standby DN prevent the reclamation of xlogs, leading to their continuous accumulation.	During the **redo checkpoint** operation on the standby DN, the detection of incomplete btree splitting triggers an RM 11 error. This may indicate a btree splitting failure or that the process is still ongoing.	8.1.3.323 and earlier versions	
	If a lightweight update occurs on a column-store table while autovacuum runs in the background, the system may report an error **Unsupported to update different rows with the same cuid and col in light update**.	In lightweight update, the same cuid and col cannot be used to update different rows.	8.1.3.323 and earlier versions	
	The **no_merge** hint operation does not take effect in some scenarios.	The subquery hint function cannot be disabled.	8.1.3.323 and earlier versions	
	When a long-time query statement is executed on the background, if you press Ctrl+C to end the statement and then press Ctrl+Z to exit the gsql client, residual statements exist.	Upon receiving the CTRL+C signal, the CN thread enters the error jump process. In this case, the CN thread invokes EmitErrorReport, but EmitErrorReport does not respond to the signal.	8.1.3.323 and earlier versions	

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	When a wide table is used with a real-time table for associated update, the memory usage is too high, affecting the performance.	Associating a wide table with a real-time table for updates introduces superfluous columns. This leads to excessive memory consumption during the optimizer's execution plan estimation, thereby deteriorating performance	8.1.3.323 and earlier versions	
	In the ShareScan plan, the memory of the tuplestore and batchstore for storing CTEs cannot be expanded. As a result, data may be written to disks.	cteMaxMem in the ShareScan execution plan is not copied, read, or written. As a result, the DN fails to obtain the value from the CTE execution plan, and the created tuplestore and batchstore for storing the CTE result set cannot be expanded in memory. As a result, data spills to disks.	8.1.3.323 and earlier versions	
	The error message **could not determine data type of parameter** is reported when a lightweight column-store update is performed.	In the remote query of the execution plan, the **parame** parameter is specified as its position in the base table, and the system column cannot match this parameter.	8.1.3.323 and earlier versions	

8.1.3.322

Table 1-14 New features/Resolved issues in version 8.1.3.322

Type	Feature or Resolved Issue	Cause	Version	Handling Method
New features	The default value of the GUC parameter **enable_limit_stop** is changed to **on**.	-	-	-
Resolved issues	None	-	-	-

8.1.3.320

Table 1-15 New features/Resolved issues in version 8.1.3.320

Type	Feature or Resolved Issue	Cause	Version	Handling Method
New features	Concurrent truncate, exchange, and select operations Added the GUC parameter **ddl_select_concurrent_mode**. This parameter is used to solve the problem that the query statement lasts for a long time and blocks DDL in the scenario where the data volume is large or the query is complex. The effect is the same as that of the Oracle database. Application scenarios: ● Concurrent truncate and select operations ● Concurrent exchange and select operations Scenario constraints ● Concurrency is not supported when there are conflicts with locks of higher levels (more than one level). For example, **autoanalyze** is triggered by **select** when **autoanalyze_mode** is set to **normal**. ● Concurrency is not supported when there are conflicts with locks in transaction blocks.	-	-	-

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	Connection constraints: • When the JDBC, ODBC, or Python driver is used, if **autocommit** is set to **false**, this feature is not supported. • This feature is not supported by query statements delivered by Data Studio and auto-committed transactions.			
	Whether to enable early stop optimization for LIMIT statements can be controlled. Added the GUC parameter **enable_limit_stop** to specify whether to enable the early stop optimization for LIMIT statements.	-	-	-
Resolved issues	The statement-level estimated memory exceeds the value of **max_process_memory** and causes ccn queuing.	The statement-level estimated memory exceeds the value of **max_process_memory**.	8.1.3.310 and earlier versions	Upgrade the version to 8.1.3.320 or later.
	When the MERGE operation is performed, an error message**value xxx is out of range for type integer** is displayed.	The **pg_toast_get_baseid()** function uses an integer interface for OID processing.	8.1.3.310 and earlier versions	

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	Querying the dirty page rate view of a large table containing 200,000 data rows results in significant memory consumption.	In the process of data querying, each node in the statistics-querying linked list requests memory to store tupStatus. Post-query, while the nodes' memory is freed, the allocated memory within the nodes for tupStatus remains unreleased.	8.1.1.x	
	When a Vacuum operation times out and is terminated, some DNs retain leftover threads, which then fail to respond to signals and obstruct the execution of subsequent statements.	The btvacuumscan thread does not respond to signals. As a result, after the Vacuum execution times out and is killed, some DNs have residual threads and cannot respond to signals.	8.1.1.x	
	Executing percentage sampling on partitioned and time series tables within the MySQL compatibility library triggers an error: "unsupported feature with temporary/ unlogged table for partitioned table".	In 8.1.3, the default inheritance mode is INCLUDING ALL to match the CREATE TABLE LIKE syntax in MySQL. However, this causes an error during ANALYZE percentage sampling because the command for automatically creating temporary replication tables is included the sampling.	8.1.3.310 and earlier versions	

Type	Feature or Resolved Issue	Cause	Version	Handling Method
	The SELECT query of the cold and hot tables triggers **runtime autoanalyze**, deteriorating the query performance.	If the select operation is performed After the TRUNCATE PARTITION, EXCHANGE PARTITION, DROP PARTITION, ALTER DISTRIBUTE, or ALTER COLUMN TYPE operation, AUTOANALYZE is triggered.	8.1.3.310 and earlier versions	
	The value of **elapsed_time** in **pg_session_wlmstat** is inconsistent with the actual execution time of the top SQL statement.	When querying the **pg_session_wlmstat** view, the **elapsed_time** value appears excessively high for statements in the RUNNING state.	8.0.x	
	When the SELECT permission is granted to a foreign table, the error message "has no distribute type" is displayed.	The default distribution mode is not specified for the OBS dfs server write-only foreign tables.	8.1.3.310 and earlier versions	

1.4 Version 8.1.1

V8.1.1.500 release date: June 20, 2022

[Release date of V8.1.1.300]: April 15, 2022

[Release date of V8.1.1.205]: March 30, 2022

[Release date of V8.1.1.203]: March 18, 2022

[Release date of V8.1.1.202]: February 24, 2022

[Release date of V8.1.1.201]: January 25, 2022

[Release date of V8.1.1.200]: December 9, 2021

[Release date of V8.1.1.100]: July 30, 2021

NOTE

The database kernel functions of clusters 8.1.1.200, 8.1.1.201, 8.1.1.202, 8.1.1.203, 8.1.1.205, 8.1.1.300, 8.1.1.500, and 8.1.1.100 are the same. Some functions are adapted to the management console. For details, see .

New features

Table 1-16 New Functions in 8.1.1

Feature	Description	Reference
2048 nodes in a cluster	Supported up to 2048 nodes in a cluster.	
Resource monitoring performance tuning	1. Added functions **pgxc_wlm_get_schema_space(cstring)** and **pgxc_wlm_analyze_schema_space(cstring)**. 2. Added system views **PGXC_TOTAL_SCHEMA_INFO**, **PGXC_TOTAL_SCHEMA_INFO_ANALYZE**, and **GS_WLM_SQL_ALLOW**.	
Lightweight **UPDATE**	1. Added descriptions about column-store tables and the lightweight UPDATE operation on column-store tables to "Precautions". 2. Added the GUC parameter **enable_light_colupdate**.	
Primary key CU of column-store tables	Supported primary key constraints of column-store tables.	
Space management	Added the GUC parameter **bi_page_reuse_factor**.	
GDS productization	Added system views **PGXC_BULKLOAD_PROGRESS**, **PGXC_BULKLOAD_STATISTICS**, and **PG_BULKLOAD_STATISTICS**.	

Feature	Description	Reference
Hot and cold data storage	1. Added the description of **REFRESH STORAGE** to "ALTER TABLE". 2. Added the functions and descriptions of **COLVERSION** and **STORAGE_POLICY** to "CREATE TABLE". 3. Added the function and description of the OBS tablespace to "CREATE TABLESPACE".	
C function in SM4 CBC mode	Added security functions **gs_encrypt(encryptstr, keystr, cryptotype, cryptomode, hashmethod)**, **gs_decrypt(decryptstr, keystr, cryptotype, cryptomode, hashmethod)**, and **gs_hash(hashstr, hashmethod)**. Modified the description of **gs_encrypt_aes128(encryptstr, keystr)** and **gs_decrypt_aes128(decryptstr, keystr)**.	
Support for the built-in **MEDIAN** function	Added the function **median(expression)**.	
Adjusting the cascade delete for tables with views	1. Added the description of rebuilding a view. 2. Added the following description to the **REBUILD** parameter of **ALTER VIEW**: Only columns of the character, number, and time types in the base table can be modified. When **view_independent** is set to **on**, views can be automatically rebuilt.	

Feature	Description	Reference
Custom data redaction	1. Optimized data redaction. 2. Provided data redaction functions in different forms. 3. Updated the columns in the system catalog **PG_REDACTION_COLUMN** and system view **REDACTION_COLUMNS**. 4. Added the syntax **ALTER REDACTION POLICY**, **CREATE REDACTION POLICY**, and **DROP REDACTION POLICY**.	
After the password expires, a user can log in to the database only after changing the password.	1. "Keyword" in the *SQL Syntax* Added **EXPIRATION** (non-reserved). 2. Added the security function **gs_password_expiration**, and the description that the system prompts users to change their passwords after the **gs_password_deadline** password expires. This is related to the GUC parameter **password_effect_time**. 3. Added **PASSWORD EXPIRATION period** to the syntax **ALTER ROLE**, **ALTER USER**, and **CREATE USER**. 4. Added the following description to **CREATE ROLE**: number of days before the login password of a role expires. A user needs to change the password before it expires. If the login password expires, the user cannot log in to the system. In this case, the user needs to ask the administrator to set a new login password and use it to log in to the system. 5. Added the columns **rolauthinfo**, **rolpwdexpire**, and **rolpwdtim** to the system catalog **PG_AUTHID**.	
Increasing the hash table size	Added the GUC parameter **expand_hashtable_ratio**.	
SMP adaptation enabled	Added "Suggestions for SMP Parameter Settings".	

Feature	Description	Reference
PRETTY as the default value of **EXPLAIN**	Changed the default display format of **EXPLAIN** to **PRETTY**. Added the statistics of filtering and projection time to the new operator. The statistics and the operator execution time are displayed in the same row.	
Enhanced concurrent SMP	1. Added the constraint of SMP: the short query scenario where the plan generation time accounts for a large proportion. 2. Added the description of setting **query_dop** to **1** in the short query scenario. 3. Added the GUC parameter **query_dop_ratio**.	
row2vec optimization	Added the GUC parameter **enable_row_fast_numeric**.	

Feature	Description	Reference
MySQL compatibility	1. Added the negative processing of **concat**, **log(x)**, **left**, and **right**, **last_day** and **next_day** return types of **int + unknown** operations, and compatibility differences of the operator ^. 2. Added the keywords **IFNULL** and **TIMESTAMPDIFF**. 3. Added the description of processing **CASE**, **COALESCE**, **IF**, and **IFNULL** in MySQL-compatible mode. 4. Added the MySQL-compatible schema and example of the **behavior_compat_options** option. 5. **[OFFSET start [ROW | ROWS]] | LIMIT start, { count | ALL } }]** supported by **SELECT**, **SELECT INTO**, and **VALUES**. 6. Added MySQL compatibility to the **DBCOMPATIBILITY** of **CREATE DATABASE**. 7. Added the following content: compatibility differences between **concat(str1, str2)**, **left(str text, n int)**, and **right(str text, n int)** for character processing functions and operators; compatibility differences between **log(x)** and ^ for numeric operation functions and operators; time and date processing functions and operators, **timestampdiff(field, timestamp1, timestamp2) / to_days(timestamp) / data_format**; conditional expression functions, including **if(bool_expr, expr1, expr2)**, **ifnull(expr1, expr2)**, and **isnull(expr)**.	
Support for **UPSERT**	Added the **UPSERT** syntax. Added **IGNORE**, **AS**, **ON DUPLICATE KEY**, and **ON CONFLICT** to the **INSERT** syntax.	

Feature	Description	Reference
Support for the **INSERT**, **UPDATE**, and **DELETE** operations of views	Added **Updatable Views** to "CREATE VIEW".	
One-click onsite information collection	Added the **STATS boolean** parameter to the **EXPLAIN** syntax.	
One-click relationship analysis of a lock wait	1. Added the lock information function **pgxc_get_lock_conflicts()**. 2. Added the system views **PGXC_DEADLOCK** and **PGXC_LOCK_CONFLICTS**.	
Combination with an empty string of the **CHAR** type	Added the configuration item **bpchar_text_without_rtrim** to the parameter **behavior_compat_option**.	
Support for Python 3.*x*	Supported Python 3.	
When **to_date** and **to_timestamp** process an empty string, **0001-01-01** is returned, and **null** is returned for TD.	1. Added "Syntax Compatibility Differences Among Oracle, Teradata, and MySQL". 2. Added the configuration item **convert_empty_str_to_null_td** to **behavior_compat_options**.	
Support for **INSERT OVERWRITE**	Supported **INSERT OVERWRITE**.	
Obtaining all views queried by the current user	Added the view **GS_VIEW_DEPENDENCY_PATH**.	
Support for **percentile_disc** and **percentile_cont**	Added the following aggregate functions: **percentile_disc(const) within group(order by expression)** **percentile_cont(const) within group(order by expression)**	

SQL Syntax

Table 1-17 SQL syntax

Change Type	No.	Name	Change Description
Add	1	LIMIT offset, count	The **LIMIT offset,count** syntax is supported.
	2	EXPLAIN(STATS ON)...	The **EXPLAIN(STATS ON)** syntax is supported. It is used to export information for regenerating a plan.
	3	CREATE/ALTER/DROP REDACTION POLICY	Added the syntax for masking DDL statements.
	4	INSERT IGNORE INTO INSERT INTO ON DUPLICATE KEY UPDATE INSERT INTO ON CONFLICT DO UPDATE INSERT INTO ON CONFLICT DO NOTHING	**UPSERT** is supported.
	5	INSERT OVERWRITE INTO	**INSERT OVERWRITE** is supported.
	6	ALTER TABLE REFRESH STORAGE	Users can change hot data to cold data in tables.
	7	ALTER VIEW ONLY view_name REBUILD	**ALTER VIEW ONLY** *view_name* **REBUILD** is supported.
	8	ALTER SERVER REFRESH	You can update the configuration file of the HDFS server if the HDFS configuration was modified.
Modify	9	Operator	In MySQL compatibility mode, XOR is used. In ORA or TD mode, exponentiation is used.
	10	MERGE INTO	An error will be reported if the target table of the **MERGE INTO** statement contains triggers.
	11	CREATE/ALTER Table	Added options about **cold_tablespace** and **storage_policy** in **Reloptions**.

Keywords

Table 1-18 Keywords

Change Type	No.	Name	Change Description
Add	1	TIMESTAMPDIFF	The **COL_NAME_KEYWORD** keyword is added.
	2	IFNULL	The **COL_NAME_KEYWORD** keyword is added.
	3	REFRESH	Non-reserved keyword
Modify	4	IF	**UNRESERVED_KEYWORD** is changed to **COL_NAME_KEYWORD**.
	5	ISNULL	**UNRESERVED_KEYWORD** is changed to **COL_NAME_KEYWORD**.
	6	VERIFY	This keyword is changed from reserved to non-reserved.

System Catalogs

Table 1-19 System catalogs

Change Type	No.	Name	Change Description
Modify	1	PG_REDACTION_COLUMN	The **func_expr** column is added.
	2	PG_AUTHID	The **rolpwdexpire** and **rolpwdtime** columns are added.

System Functions

Table 1-20 System functions

Change Type	No.	Name	Change Description
Add	1	pgxc_wlm_readjust_schema_space()	You can perform parallel calibration in schema space.

Change Type	No.	Name	Change Description
	2	pgxc_wlm_get_schema_space()	You can query the schema space information of the cluster.
	3	pgxc_wlm_analyze_schema_space()	You can analyze the schema space information of the cluster.
	4	gs_roach_enable_delay_ddl_recycle	You can enable DDL delay by specifying a backup set name.
	5	gs_roach_disable_delay_ddl_recycle	You can disable DDL delay by specifying a backup set name.
	6	gs_roach_stop_backup	You can disable row-store backup by specifying a backup set name.
	7	gs_roach_switch_xlog	You can configure whether to perform the checkpoint operation for xlog switch.
	8	pgxc_get_lock_conflicts()	This function returns information about conflicting locks on nodes.
	9	mask_none/mask_full/mask_partial	A built-in masking function is added.
	10	median	The median agg function is added.
	11	pgxc_node_stat_reset_time()	You can query the reset time of each node.
	12	pgxc_rel_iostat()	You can query the I/O statistics of each node.
	13	pgxc_redo_stat()	You can query the redo statistics of each node.
	14	pgxc_instance_time()	You can query the time statistics of each instance.
	15	pgxc_settings()	You can query the GUC settings of each node.
	16	pgxc_replication_slots()	You can query the replication slot statistics of each node.
	17	pgxc_stat_replication()	You can query the replication statistics of each node.

Change Type	No.	Name	Change Description
	18	pgxc_stat_bgwriter()	You can query the statistics of the bgwriter process on each node.
	19	pgxc_wait_events()	You can query statistics on the wait events of each node.
	20	pgxc_os_run_info()	You can query the OS performance statistics of the servers where instances are deployed.
	21	get_node_stat_reset_time()	You can query the time when the current node status is reset.
	22	get_local_rel_iostat()	You can query the I/O statistics of the current node.
	23	get_instr_wait_event()	You can query statistics on the wait events of the current node.
	24	pg_stat_get_db_total_blk_write_time()	You can query the total block write time.
	25	pg_stat_get_db_total_blk_read_time()	You can query the total block read time.
	26	pg_stat_get_db_total_temp_bytes()	You can query the total size of temporary files.
	27	pg_stat_get_db_total_temp_files()	You can query the total number of temporary files.
	28	pg_stat_get_db_total_deadlocks()	You can query the total number of deadlocks.
	29	pg_stat_get_db_total_conflict_all()	You can query the total number of conflicts.
	30	pg_stat_get_db_total_tuples_deleted()	You can query the total number of deleted tuples.
	31	pg_stat_get_db_total_tuples_updated()	You can query the total number of updated tuples.
	32	pg_stat_get_db_total_tuples_inserted()	You can query the total number of inserted tuples.
	33	pg_stat_get_db_total_tuples_fetched()	You can query the total number of fetched tuples.

Change Type	No.	Name	Change Description
	34	pg_stat_get_db_total_tuples_returned()	You can query the total number of returned tuples.
	35	pg_stat_get_db_total_blocks_hit()	You can query the total number of hit data blocks in the memory.
	36	pg_stat_get_db_total_blocks_fetched()	You can query the total number of read data blocks.
	37	pg_stat_get_db_total_xact_rollback()	You can query the total number of rollback transactions.
	38	pg_stat_get_db_total_xact_commit()	You can query the total number of commit transactions.
	39	pg_stat_get_db_total_numbackends()	You can query the total number of backends.
	40	gs_encrypt()	Encryption function
	41	gs_decrypt()	Decryption function
	42	gs_hash()	Hash function
	43	gs_password_expiration()	You can query the remaining password validity period (**rolpwdtime** and **rolpwdexpire** columns in the **pg_authid system** catalog) of the current user.
	44	to_char(date)	The to_char(date) function is added to be compatible with the return format of the DATE timestamp processed by to_char in TD mode.
	45	gs_wlm_set_queryband_action	You can configure the query_band load behavior.
	46	gs_wlm_set_queryband_order	You can configure the search priority of query_band.
	47	gs_wlm_get_queryband_action	You can query the **query_band** load behavior.
	48	CONCAT	A MYSQL compatibility rule is added. If the input parameter contains NULL, NULL will be returned.

Change Type	No.	Name	Change Description
	49	TIMESTAMPDIFF	The TIMESTAMPDIFF function can be used to return the time difference in a specified unit.
	50	TO_DAYS	The TO_DAYS function can return the number of days between the input time and 0.
	51	DATE_FORMAT	The DATE_FORMAT function can convert an input date and time into a string in a specified format. The string is in MYSQL format and starts with %.
	52	IF	The IF function can return the corresponding value based on the first input.
	53	IFNULL	The IFNULL function can return the first non-NULL value.
	54	ISNULL	The ISNULL function can check whether the input is NULL.
Modify	55	pg_resume_bkp_flag	You can obtain the delay DDL flag during backup and restoration.
	56	pg_query_audit	The **begintime**, **operation_type**, **command_text**, **transaction_xid** and **query_id** fields are added to audit logs. The **time** field is changed to **endtime**, and the **type** field is changed to **audit_type**. In addition, **detail_info** is used to store the command execution results instead of commands, which have been moved to **command_text**.
	57	pg_delete_audit	For security purposes, the interface for deleting audit logs cannot be provided. If this function is called, an error will be reported.

Change Type	No.	Name	Change Description
	58	log()	Logarithmic function. In ORA or TD mode, it represents a logarithm to base 10. In MySQL mode, it represents a natural logarithm.
	59	to_number	The to_number function instead of the numeric_in function is called. In TD mode, if the input is an empty string, null will be returned.
	60	left()	You can truncate a string. If the input parameter is a negative number, **-n** for example, all characters except the last */n/* character will be returned in ORA or TD mode, and an empty string will be returned in MySQL mode.
	61	right()	You can truncate a string. If the input parameter is a negative number, **-n** for example, all characters except the first */n/* character will be returned in ORA or TD mode, and an empty string will be returned in MySQL mode.
	62	last_day	Input parameters support the timestamptz type. In MySQL mode, the return type is date. In ORA or TD mode, the return type is timestamp.
	63	next_day	Input parameters support the timestamptz type. In MySQL mode, the return type is date. In ORA or TD mode, the return type is timestamp.
	64	add_months	Input parameters support the **timestamptz** type. In MySQL mode, the return type is **timestamptz**, while in ORA or TD mode, it is **timestamp**.

Change Type	No.	Name	Change Description
	65	add_months	The **date** type is added to the input parameter. In MySQL compatibility mode, the return type is **date**, whereas in ORA or TD mode, it is **timestamp**.
	66	pg_cbm_recycle_file	This parameter is added so that the concurrent backup and disaster recovery features can recycle CBM.
	67	pgxc_query_audit	The **begintime**, **operation_type**, **command_text**, **transaction_xid** and **query_id** fields are added to audit logs. The **time** field is changed to **endtime**, and the **type** field is changed to **audit_type**. In addition, **detail_info** is used to store the command execution results instead of commands, which have been moved to **command_text**.
	68	login_audit_messages	Enhanced the audit log feature.
Delete	69	add_policy/drop_policy/ alter_policy/enable_policy/ disable_policy	The old data making interface was deleted.

System Views

Table 1-21 System views

Change Type	No.	Name	Change Description
Add	1	GS_WLM_SQL_ALLOW	You can query the existing whitelist.
	2	PG_TOTAL_SCHEMA_INFO	You can query the schema space information of a node.
	3	PGXC_TOTAL_SCHEMA_INFO	You can query the schema space information of a cluster.

Change Type	No.	Name	Change Description
	4	PGXC_TOTAL_SCHEMA_INFO_ANALYZE	You can analyze the schema space information of the cluster.
	5	PGXC_LOCK_CONFLICTS	You can query the information about conflicting locks on each node.
	6	PGXC_DEADLOCK	You can query the information about lock waits in a distributed deadlock (including information about lock objects and lock holders).
	7	PGXC_NODE_STAT_RESET_TIME	You can query the node reset time.
	8	GS_NODE_STAT_RESET_TIME	You can check the reset time of the current node.
	9	GLOBAL_STAT_DATABASE	You can query global database statistics.
	10	GLOBAL_REL_IOSTAT	You can query global I/O statistics.
	11	PGXC_REL_IOSTAT	You can query node I/O statistics.
	12	GS_REL_IOSTAT	You can query the I/O statistics of the current node.
	13	GLOBAL_REDO_STAT	You can query global redo statistics.
	14	PGXC_REDO_STAT	You can query node redo statistics.
	15	GLOBAL_WORKLOAD_TRANSACTION	You can query global workload transaction statistics.
	16	PGXC_INSTANCE_TIME	You can query instance time statistics.
	17	PGXC_SETTINGS	You can query node GUC settings.
	18	PGXC_REPLICATION_SLOTS	You can query the replication slot statistics of the nodes.
	19	PGXC_STAT_REPLICATION	You can query the replication statistics of the nodes.

Change Type	No.	Name	Change Description
	20	PGXC_STAT_BGWRITER	You can query node bgwriter statistics.
	21	PGXC_WAIT_EVENTS	You can query wait events on the nodes.
	22	GS_WAIT_EVENTS	You can query wait event statistics of the current node.
	23	PGXC_OS_RUN_INFO	You can query the OS performance statistics of the servers where instances are deployed.
	24	PG_LIFECYCLE_DATA_DISTRIBUTE	You can query the data distribution statistics of OBS cold and hot tables.
	25	PG_BULKLOAD_STATISTICS	You can encapsulate the pg_stat_get_node_bulkload_statistics function.
	26	PGXC_BULKLOAD_STATISTICS	You can encapsulate the pgxc_stat_get_node_bulkload_statistics function.
	27	PGXC_BULKLOAD_PROGRESS	This function can aggregate the query results of the **pgxc_bulkload_statistics** view and calculate the GDS service progress percentage.
	28	PG_QUERYBAND_ACTION	You can query all the query_band load behaviors.
	29	GS_VIEW_DEPENDENCY_PATH	You can query the dependency between cascading query views.
Modify	30	REDACTION_COLUMNS	The **function_infos** column is added to the system view definition.
	31	PGXC_GET_TABLE_SKEWNESS	Fixed the problem that the round-robin table is not displayed in the **PGXC_GET_TABLE_SKEWNESS** view.
	32	PGXC_STAT_DATABASE	You can query database statistics on each instance.

Behavior Changes

Table 1-22 Behavior changes

Change Type	No.	Name	Change Description
Modify	1	If the Not-null and CHECK constraints conflict, the details of the entire row are not printed.	If the Not-null and CHECK constraints conflict, the details of the entire row are not printed.
	2	Compatible with C80 behavior. By default, the implicit type conversion from interval to text is not matched.	If **behavior_compat_options** is set to **enable_interval_to_text**, this implicit type conversion is supported.
	3	Date type	In ORA mode, the date type is reversely parsed as **pg_catalog.date**.
	4	Agg plan	Required columns are generated when agg generates a stream plan.
	5	Median is used with collate.	Collate cannot be used with median, percentile_cont, or percentile_disc.
	6	Modifications on multi-column partitioning	The rule to check the boundary values of multiple columns during partition modification. If the boundary value of a column is the maximum value, the boundary values of other columns are ignored.

Change Type	No.	Name	Change Description
	7	Generate a plan with **enable_nestloop** is set to **off** and no association conditions.	Assume there are two tables that do not have equivalent join conditions with each other, but have equivalent join conditions with other tables. If the number of joined rows increases, the nestloop plan can be executed. After the rectification, the nestloop plan cannot be executed. For equivalent join columns that do not support hashjoin, if **mergejoin** is set to **off**, the nestloop cost will change. The execution plan will change from Nestloop + Indexscan to Nestloop + Materialize.

GUC Parameters

Table 1-23 GUC parameters

Change Type	No.	Name	Change Description
Add	1	behavior_compat_options	• The **convert_empty_str_to_null_td** option is added to be compatible with the to_date, to_timestamp, and to_number functions that return null after processing an empty string in TD mode. • The **enable_interval_to_text** option is added to determine whether to support the implicit conversion from interval to text.
	2	debug_group_dop	You can configure the DOP of each stream group for statement-level optimization during SMP adaptation. This value is left empty by default.

Change Type	No.	Name	Change Description
	3	enable_row_fast_numeric	Numeric data in row-store tables is flushed to disks in bigint format.
	4	expand_hashtable_ratio	Dynamic extension of the hash table
	5	query_dop_ratio	A logic DOP makes decisions based on the system resources and cost. If the decisions are inaccurate, a parameter is added for escape. The default value is **1**.
	6	show_unshippable_warning	A parameter is added to determine whether to print logs that have not been pushed down to the client. By default, the function is disabled.
	7	assign_abort_xid	Session-level parameters are added. If data is deleted by mistake, incomplete recovery can be performed quickly. This parameter is left blank by default. The GUC parameter indicates rolling back the transaction submitted by a specific xid.
	8	bi_page_reuse_factor	Idle FSM factor during batch insert reuse (**0** indicates returning to the old logic)
	9	check_cu_size_threshold	Userset level. When data is inserted to a column-store table, if the amount of data inserted to a CU is greater than **check_cu_size_threshold**, row size will be checked to avoid generating CUs greater than 1 GB.
	10	enable_light_colupdate	Userset level, indicating whether lightweight update is enabled.

Change Type	No.	Name	Change Description
Modify	11	cost_model_version	The parameter value option **2** is added. The default value **1** remains unchanged. If the value is less than 2, the original function will be used for fixed value sampling. If the value is greater than 2, the function improved to enhance randomness is used for fixed value sampling.
	12	expected_computing_node group	After an in-place upgrade, set **expected_computing_nodegroup** to **bind**.
	13	query_dop	For a newly installed cluster, the default value is changed to **1**. For an upgraded cluster, the default value remains unchanged.

1.5 Deleted Database Interfaces

To facilitate the ongoing development and maintenance of GaussDB(DWS), a metadata sunset feature is implemented to phase out outdated GUC parameters, system functions, and system views. For the sake of preserving historical compatibility, deprecated functions and views are archived within the user-created SUNSET EXTENSION, ensuring that they do not interfere with future version upgrades.

CREATE EXTENSION SUNSET

When there are attempts to access deprecated system functions and views, an error will be displayed, indicating their non-existence. GaussDB(DWS) facilitates the creation of these legacy system functions and views using the CREATE EXTENSION SUNSET statement. This extension encapsulates the sunset functions and views, preserving their original definitions prior to sunset.

Here is how to create it:

The administrator executes the **CREATE EXTENSION SUNSET** command to establish the extension. This extension needs to be created only once by the user. The access permissions for the sunset functions and views remain consistent with those from the pre-sunset version.

```
CREATE EXTENSION sunset;
CREATE EXTENSION

 \dx+ sunset
                                                  Objects in extension "sunset"
                                                       Object
```



```
Description
------------------------------------------------------------------------------------------------------------------------------------------------------
 function pg_delete_audit(timestamp with time zone,timestamp with time zone)
 function pg_log_comm_status()
 function pg_stat_get_realtime_info_internal(oid,oid,bigint,cstring,oid)
 function pg_stat_get_wlm_session_info_internal(oid,oid,bigint,oid)
 function pg_stat_get_wlm_session_info(oid)
 function pg_stat_get_wlm_session_iostat_info(integer)
 function pg_stat_get_wlm_statistics(integer)
 function pg_sync_cstore_delta()
 function pg_sync_cstore_delta(text)
 function pg_user_iostat(cstring)
 function pgxc_log_comm_status()
 function pgxc_pool_check()
 function signal_backend(bigint,integer)
 function update_pgjob(bigint,"char",bigint,timestamp without time zone,timestamp without time
zone,timestamp without time zone,timestamp without time zone,timestamp without time zone,smallint)
 view gs_wlm_session_info_all
 view pg_session_iostat
 view pg_wlm_statistics
(17 rows)
```

Deleted Database Interfaces of the 8.3.0 Cluster Version

Table 1-24 Sunset system functions and views

Type	Item	Description
Functions	pg_sync_cstore_delta(text)	Merges delta table data to the primary table in column-store mode. This function has been deprecated. It is replaced by the **VACUUM DELTAMERGE xxx** syntax.
	pg_sync_cstore_delta	Merges delta table data to the primary table in column-store mode. This function has been deprecated. It is replaced by the **VACUUM DELTAMERGE xxx** syntax.
	pgxc_pool_check	Checks whether the connection data cached in the connection pool is consistent with **pgxc_node**. This function has been deprecated.
	pg_delete_audit	Deletes audit logs. This function has been deprecated. Manual deletion of audit logs is not allowed.
	pg_log_comm_status	Indicates the log recording status of the internal structure of the SCTP communication layer on the current node. This function has been deprecated.
	pgxc_log_comm_status	Indicates the log recording status of the internal structure of the SCTP communication layer on all nodes. This function has been deprecated.
	signal_backend	This function has been deprecated.

Type	Item	Description
	pg_stat_get_realtime_info_internal	Obtains real-time top SQL information at the query level. This function has been deprecated. It is replaced by the **PGXC_WLM_SESSION_STATISTICS** view.
	pg_stat_get_wlm_session_info_internal	Obtains top SQL information at the query level. This function has been deprecated. It is replaced by the **pg_stat_get_wlm_realtime_session_info** function.
	pg_stat_get_wlm_session_info	Obtains session information. This function has been deprecated. It is replaced by the **PGXC_WLM_SESSION_INFO** view.
	pg_stat_get_wlm_statistics	Obtains session information. This function has been deprecated. It is replaced by the **PGXC_WLM_SESSION_INFO** view.
	pg_user_iostat	Obtains the I/O information of a user. This function has been deprecated. It is replaced by the **PGXC_TOTAL_USER_RESOURCE_INFO** view.
	pg_stat_get_wlm_session_iostat_info	Obtains the I/O information of a query. This function has been deprecated. It is replaced by the **PGXC_WLM_SESSION_STATISTICS** or **PGXC_WLM_SESSION_INFO** view.
System views	gs_wlm_session_info_all	Obtains session information. This view has been deprecated. It is replaced by the **PGXC_WLM_SESSION_INFO** view.
	pg_wlm_statistics	Displays load management information after a job is complete or an exception has been handled. This view has been deprecated. It is replaced by the **PGXC_WLM_SESSION_INFO** view.
	pg_session_iostat	Obtains the I/O information of a session. This view has been deprecated. It is replaced by the **PGXC_WLM_SESSION_STATISTICS** view.

Deleted Database Interfaces of the 9.1.0 Cluster Version

Table 1-25 Sunset database interfaces

Type	Item	Description
Extension	file_fdw	Local file access, which is deprecated.

Type	Item	Description
External server	gsmpp_errorinfo_server	This interface is used for reading data from the import error table, but it has been discarded. Accessing the import error table no longer requires **gsmpp_errorinfo_server**.
Logical replication	pg_create_logical_replication_slot	Creates a logical replication slot. This has been discarded in 9.1.0.200. The logical replication feature has been discarded.
Logical replication	pg_logical_slot_peek_changes	Decodes changes without pushing them to the replication slot. This has been discarded in 9.1.0.200. The logical replication feature has been discarded.
Logical replication	pg_logical_slot_get_changes	Decodes and pushes changes to the stream replication slot. This has been deprecated in 9.1.0.200. The logical replication feature has been discarded.

2 Version Support Notes

The cluster version of GaussDB(DWS) displayed on the management console is in the format of x.y.z.p, which is explained in **Figure 2-1**.

Generally, new functions and features of GaussDB(DWS) are released by release number, for example, 8.1.3 and 8.2.0.

After each iteration version is released, a patch is released to fix problems, for example, patch 8.1.3.322. A patch only fixes problems and does not add new functions or features.

Figure 2-1 GaussDB(DWS) version description

Version Lifecycle

Table 2-1 provides the lifecycle of GaussDB(DWS) versions (release number), helping you plan your version update.

For versions that have reached EOS or are not **Recommended Version**, you are advised to upgrade them to the latest stable version by referring to **Version Upgrade Policies**.

Table 2-1 GaussDB(DWS) version lifecycle

Version	Running status	Released On	EOM Date (End of Marketing)	EOS Date (End of Service)
8.1.3.x	Released	2022-04-15	2024-06-30	2025-12-31
8.1.1.x	EOM	2021-07-30	2023-06-30	2025-12-31

Version Upgrade Policies

Table 2-2 Version incorporation

Source Version	EOS	Suggestion	Upgrade Plan
1.5.x/1.6.x	Yes	Direct upgrade is not supported. You are advised to migrate data to **8.1.3.336** (recommended version).	You are advised to contact technical support engineers for evaluation before performing this operation.
1.7.x	Yes	You are advised to upgrade the version to **8.1.3.336** (recommended version).	You cannot directly upgrade to version 8.1.3.336 from your current version. Instead, a multi-hop upgrade is required. Contact technical support for evaluation before the upgrade.
8.0.1.x	No	You are advised to upgrade the version to **8.1.3.336** (recommended version).	You cannot directly upgrade to version 8.1.3.336 from your current version. Instead, a multi-hop upgrade is required. Contact technical support for evaluation before the upgrade.

Source Version	EOS	Suggestion	Upgrade Plan
8.1.0.x	No	You are advised to upgrade the version to **8.1.3.336** (recommended version).	You cannot directly upgrade to version 8.1.3.336 from your current version. Instead, a multi-hop upgrade is required. Contact technical support for evaluation before the upgrade.
8.1.1.x~8.1.3.323	No	You are advised to upgrade the version to **8.1.3.336** (recommended version).	It can be directly upgraded to 8.1.3.336. You are advised to contact technical support for evaluation before the upgrade. It can be upgraded on the console. For details, see **Upgrading a GaussDB(DWS) Cluster**.
8.3.0.x	No	You are advised to upgrade the version to 8.3.0.110.	It can be directly upgraded to 8.3.0.110. You are advised to contact technical support for evaluation before the upgrade. It can be upgraded on the console. For details, see **Upgrading a GaussDB(DWS) Cluster**.
9.0.1/9.0.2	No	You are advised to upgrade the version to **9.1.0.105**.	You cannot directly upgrade to version **9.1.0.105** from your current version. Instead, upgrade to 9.0.3 and then to 9.1.0.105. You can upgrade the cluster on the console. For details, see **Upgrading a GaussDB(DWS) Cluster**.

Source Version	EOS	Suggestion	Upgrade Plan
9.0.3/9.1.0.x	No	You are advised to upgrade the version to **9.1.0.105**.	It can be directly upgraded to 9.1.0.105. You are advised to contact technical support for evaluation before the upgrade. It can be upgraded on the console. For details, see **Upgrading a GaussDB(DWS) Cluster**.