
# What's new in Postgres 17

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# Development Schedule

- June 2023 - branch 16
- July 2023 - CF1
- September 2023 - CF2
- November 2023 - CF3
- January 2024 - CF4
- March 2024 - CF5
- September 2024 - RC1
- 2024-09-26 release 17.0

# Current Status

- 2681 commits
- 3958 files changed, 419663 insertions(+), 217841 deletions(-)

https://www.postgresql.org/docs/release/17.0/

pgconf.dev 2024

https://www.youtube.com/@pgconfdev

# New Features

- DBA and administration
- SQL and developer
- Backup and replication
- Performance

# Breaking changes I.

Microsoft

- building
  - Windows MSVC builds removed (we now have meson)
  - AIX support removed (but people are working on it)
  - --disable-thread-safety (sufficiently good threading expected)
- removed
  - adminpack (not needed, pgadmin III is EOL)
  - db_user_namespace (pretty much never used)
  - snapshot too old (known correctness/performance issues, might be reintroduced)

# Breaking changes II.

Microsoft

- pg_stat_bgwriter
  - Removed checkpoints_timed & req => pg_stat_checkpointer
  - Removed write_time & sync_time => pg_stat_checkpointer
  - Removed buffers_checkpoint, backend & fsync => pg_stat_io
- search_path during maintenance ops
  - expression indexes & materialized views
  - Secured by default!
  - Must be explicit!
  - ANALYZE, CLUSTER, REINDEX, REFRESH MATERIALIZED VIEW, VACUUM

Microsoft

# DBA and administration

# DBA and administration

Microsoft

- transaction_timeout
  - similar to statement_timeout, partial replacement for "snapshot too old"
  - not for PREPARED transactions
- event triggers
  - REINDEX
  - login (a bit of a footgun: bug => login impossible, long queries a problem too)
  - event_triggers=false (temporary disable, for debugging, fix for login trigger)
- wait events
  - pg_wait_events (descriptions of wait events, not aggregation/summary)
  - custom wait events (defined by extensions)
  - new wait events (checkpoint delays)

# DBA and administration

```
test=# select * from pg_wait_events ;
   type      |            name                |                          description
-------------+--------------------------------+---------------------------------------------------------------
 Activity    | ArchiverMain                   | Waiting in main loop of archiver process
 Activity    | AutovacuumMain                 | Waiting in main loop of autovacuum launcher process
 Activity    | BgwriterHibernate              | Waiting in background writer process, hibernating
 Activity    | BgwriterMain                   | Waiting in main loop of background writer process
 Activity    | CheckpointerMain               | Waiting in main loop of checkpointer process
 Activity    | LogicalApplyMain               | Waiting in main loop of logical replication apply
 Activity    | LogicalLauncherMain            | Waiting in main loop of logical replication launcher
 ...
 Timeout     | SpinDelay                      | Waiting while acquiring a contended spinlock
 Timeout     | VacuumDelay                    | Waiting in a cost-based vacuum delay point
 Timeout     | VacuumTruncate                 | Waiting to acquire an exclusive lock to truncate ...
 Timeout     | WalSummarizerError             | Waiting after a WAL summarizer error
(266 rows)
```

# DBA and administration

Microsoft

- pg_stat_bgwriter
  - removed checkpoints_timed & req
  - removed write_time & sync_time
  - removed buffers_checkpoint, backend & fsync
- pg_stat_checkpointer (new thing)
- pg_stat_statements
  - add local block I/O timing (already had shared I/O)
  - add entry time, JIT, min/max statistics (can be reset separately)
  - normalize CALL / SAVEPOINT / PREPARE params (to the usual $1, $2, $3, ...)
- pg_stat_vacuum_progress
  - shows index progress (indexes_total, indexes_processed)

# DBA and administration

```
test=# select * from pg_stat_checkpointer ;
-[ RECORD 1 ]-------+------------------------------
num_timed           | 6
num_requested       | 6
num_done            | 7
restartpoints_timed | 0
restartpoints_req   | 0
restartpoints_done  | 0
write_time          | 112467
sync_time           | 629
buffers_written     | 1734
slru_written        | 11
stats_reset         | 2024-11-01 17:56:38.163485+01
```

# DBA and administration


- EXPLAIN (SERIALIZE)
  - Show time and memory to serialize data
- COPY
  - ON_ERROR 'ignore'

# DBA and administration

```
CREATE TABLE t (a TEXT);

INSERT INTO t SELECT (
    SELECT string_agg(md5(i::text),'') FROM generate_series(1,1000) S(i)
) FROM generate_series(1,8192) x;

VACUUM ANALYZE t;

EXPLAIN ANALYZE SELECT * FROM t;
                                                    QUERY PLAN
-------------------------------------------------------------------------------------------------------------------
 Seq Scan on t  (cost=0.00..125.08 rows=7208 width=32) (actual time=0.054..1.668 rows=8192 loops=1)
 Planning Time: 0.116 ms
 Execution Time: 2.229 ms
(3 rows)
```

# DBA and administration


```
\timing
\o /dev/null
SELECT * FROM t;
Time: 784.096 ms
```

# DBA and administration

```
EXPLAIN (ANALYZE, SERIALIZE) SELECT * FROM t;

                                                    QUERY PLAN
-------------------------------------------------------------------------------------------------------------------
 Seq Scan on t  (cost=0.00..134.92 rows=8192 width=18) (actual time=0.136..2.905 rows=8192 loops=1)
 Planning Time: 0.117 ms
 Serialization: time=605.642 ms  output=256048kB  format=text
 Execution Time: 609.632 ms
(4 rows)
```

# DBA and administration

```
CREATE TABLE t (a INTEGER);

COPY t FROM '/home/user/test.csv' WITH (FORMAT csv);
ERROR:  invalid input syntax for type integer: "hello"
CONTEXT:  COPY t, line 5, column a: "hello"

COPY t FROM '/home/user/test.csv' WITH (FORMAT csv, ON_ERROR ignore);
NOTICE:  1 row was skipped due to data type incompatibility
COPY 4
```

# DBA and administration

Microsoft

- grant maintenance tasks (permissions) to non-table-owners
  - VACUUM, ANALYZE
  - CLUSTER
  - REINDEX
  - REFRESH MATERIALIZED VIEW
  - LOCK TABLE
- MAINTAIN privilege (per table)
- pg_maintain
  - role granting MAINTAIN on all objects

# DBA and administration

Microsoft

- builtin locale provider
  - Only for "C" and "C.UTF-8"
  - Faster! Stable! No external dependency.
  - https://youtu.be/KTA6oau7tl8
- Direct TLS handshake
  - sslnegotiation=direct
  - without negotiation, saves a roundtrip
  - friendlier to proxies
  - always with ALPN (https://en.wikipedia.org/wiki/Application-Layer_Protocol_Negotiation)

# DBA and administration

Microsoft

- allow_alter_system
  - disable the ALTER SYSTEM command
  - NOT a security feature
  - mostly "protection" for Kubernetes (config managed by resource definition)
  - but (determined) superusers can still change configuration!

Microsoft

# SQL and developer

# SQL and developer

- PQchangePassword
  - New libpq function
  - Use to.... Change passwords!
  - Used to be psql-only (\password)

# SQL and developer

Microsoft

- int to binary and octal
  - to_bin(123), to_oct(123)
- infinite intervals
- random(min, max) range
  - used to be "double precision" in [0.0, 1.0)
  - now int, bigint, numeric
- MERGE
  - can modify updatable views
  - WHEN NOT MATCHED BY SOURCE (our extension of SQL standard, also BY TARGET)
  - MERGE RETURNING (merge_action() reports action performed)

# SQL and developer

Microsoft

- JSONPATH
  - Many new operators
  - Convert between "data types"
  - e.g. .string() and .boolean()
- SQL/JSON functions
  - New functions from the standard
  - JSON_EXISTS()
  - JSON_QUERY()
  - JSON_VALUE()
- https://youtu.be/-60ZceCdtSY

# SQL and developer

- JSON_TABLE
  - Convert JSON to relational
  - Like XMLTABLE
  - Single value to multiple columns
  - In one pass
- https://youtu.be/-60ZceCdtSY

Microsoft

# Backup and replication

# Backup and replication

Microsoft

- pg_dump
  - Get list of include/exclude from file
- Incremental pg_basebackup
  - back up only changed pages/blocks
  - uses wal summarizer
  - nackup references manifest from full backup
  - to restore, use pg_combinebackup
  - https://www.postgresql.eu/events/pgconfeu2024/schedule/session/5718-incremental-backup/

# Backup and replication

Microsoft

- Preserve subscriptions across upgrades
  - preserves full subscription state (publisher + subscriber)
  - pg_upgrade
  - upgrade without rebuilding subscribers
- Sync logical replication slots between physical replicas
  - failover enabled on each slot
    - pg_create_logical_replication_slot()
    - CREATE SUBSCRIPTION
  - enable sync_replication_slots on standby
  - configure standby_slot_names

# Backup and replication

Microsoft

- pg_createsubscriber
  - cew commandline tool
  - convert physical to logical
  - much faster initial build!
  - before: create a new empty instance + copy all tables + setup slots + ...
  - now: pg_basebackup + pg_createsubscriber (faster, more efficient)
- https://www.postgresql.eu/events/pgconfeu2024/schedule/session/5853-speeding-up-logical-replication-setup/

Microsoft

# Performance

# Performance

Microsoft

- Many infrastructure improvements
  - no direct visibility
  - just runs faster
  - (almost every version)
- COPY performance
  - uuid_out
  - COPY TO when encoding matches

# Performance

- VACUUM memory
  - VACUUM uses much less memory
  - internal datastructure changes
  - often an order of magnitude
  - fewer scans!
  - https://youtu.be/-qPSN1YA19w
- Redundant NOT NULL
- Parallel CREATE INDEX for BRIN

# Performance

Microsoft

- SLRU caches
  - divide cache into banks
  - separate locking
  - configure each size independently (if needed, most grow with shared buffers)
  - xxxx_buffers
  - pg_stat_slru
  - https://youtu.be/74xAqgS2thY

# Performance

Microsoft

- Vectored I/O
  - Numerous operations use it
  - Better performance for random
  - And foundation for aio
- Streaming I/O
  - Internal API for streamed I/O
  - Callback driven
  - Combines reads, Issues fadvise
  - More foundation for aio
- https://youtu.be/7HHcD2shS4o

# There's always more

- Lots of smaller fixes
- Performance improvements
- etc, etc
- Can't mention them all!

**Test, test, test!**

# Resources

Microsoft

- release notes
  - https://www.postgresql.org/docs/release/17.0/
- pgconf.dev 2024 (Vancouver, May)
  - https://www.pgevents.ca/events/pgconfdev2024/schedule/
  - https://www.youtube.com/@pgconfdev
- pgconf.eu 2024 (Athens, October)
  - https://www.postgresql.eu/events/pgconfeu2024/schedule/
  - https://www.youtube.com/@pgeu

# Prague PostgreSQL Developer Day 2025 (P2D2)

Microsoft

https://p2d2.cz/call-for-papers / https://p2d2.cz/call-for-sponsors