Why you need to upgrade

Jimmy Angelakos

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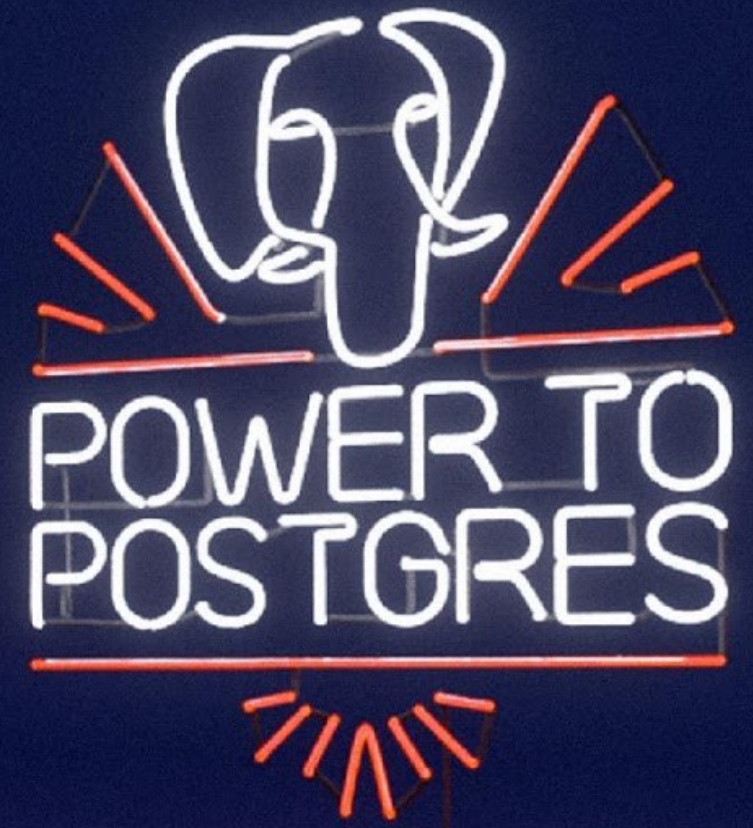

EDB

We'll be looking at:

- The PostgreSQL development cycle
- Why you need to upgrade regularly
- Minor – Major version upgrades
- What works great or better than other DBs
- Pain points & suggested improvements

Which Postgres version are **you** on?

Fear of upgrading

- “It works fine now”
  - What about tomorrow?
- Afraid it’s going to cause problems
  - Upgrade may contain a bug
  - Incompatibility with application
  - “Don’t touch it, you might break it” – how well do you know your system?
- Change process laborious
  - Change request / approval process
  - Downtime / co-ordination with other departments

Result: Ignore the new version

The PostgreSQL development cycle

PostgreSQL development

Postgres has over 30 years of active development

- Strong reputation for:
  - Reliability & data integrity
  - Proven architecture & feature robustness
  - Extensibility
  - Dedication of the open source community
- Open source development model
  - Non-trivial changes are discussed (pgsql-hackers)
  - Submit patch, tests & documentation
  - Add to commitfest
  - Review & discussion

Minor – Major releases

Minor releases

- At least one minor release every quarter
- Versioning: last part i.e. 14.**4**
- Bugfixes
- Security issues
- Data corruption issues
- No internal format changes, no new features
- The community considers not upgrading to be riskier than upgrading

Major releases

- New major version about once a year
- Versioning: first part (post-PG10) i.e. **14**.4
- New features (thoroughly vetted)
- Usually change internal format of system tables, data files
- No backward compatibility of stored data
- Supported for 5 years after initial release
- What keeps Postgres moving forward

Backward compatibility

Why something that was written for PG 9.3 will work with PG 15*

- *Usually!
  - SQL is SQL
  - Upgrades are reliable
- User-visible changes listed in release notes
  - Section “Migration”
  - May require application changes (rare)
- Can upgrade from one major version to another w/o upgrading to intervening versions
- Read the major release notes of all intervening versions
- PostgreSQL: Documentation: 20.13. Version and Platform Compatibility
  - https://www.postgresql.org/docs/current/runtime-config-compatible.html

Why you need to upgrade regularly

Upgrade regularly

Why?

- Benefits of open source
  - Unmatched ability to issue updates rapidly
  - For bugs and security vulnerabilities
- Bugfixes keep streaming in
  - Recently introduced regressions
  - Long-standing bugs undetected for years
  - Contributed by a wide range of people
    - Professionals paid to enhance Postgres
    - Individual contributors spotting an issue
- Security updates eliminate threats
  - Known to roll out in a matter of hours
  - Unheard of in proprietary software

False sense of stability

“A tested and monitored system is stable”

- Reality
  - According to our insights
  - To the best of our ability
  - Not objectively
- Software considered to be extremely stable
  - Discovery of latent bugs
  - Triggering of unexpected behaviours in software
  - New security vulnerabilities
- Don’t forget about extensions!
  - They get bugfixes too
  - But they have their own release schedules

Fear of upgrading

Associated with:

- No zero-downtime procedure defined
  - Or even upgrade procedure defined (!)
- Reluctance to schedule maintenance windows
  - Organisational issues
- Too much faith in our own tests
  - Not enough in others'
- Cumbersome deployment procedure
  - Discourages from deploying often
- Lack of QA system for testing upgrades frequently

FOMO

Fear Of Missing Out

- Missing out on newer features
- Stayed on PG 9.6, didn't get:
  - Native partitioning
  - Logical replication
- Stayed on PG11, didn't get:
  - `pg_checksums`
  - Generated columns
- Stayed on PG13, didn't get:
  - Throughput improvement for large numbers of connections
  - Streaming of large transactions
  - `libpq` pipelining

Minor – Major version upgrades

Minor release upgrades

What they involve

- Always recommended to run latest available minor release for major version used
  - No new features / deprecations
  - Only necessary bugfixes / security issues
  - Minimal risk
- Upgrading to a minor release does not touch stored data files
- Quick and easy to perform
- For some releases, manual changes may be required to complete the upgrade
  - Always read the release notes before upgrading

Minor release upgrades

What to test

- Normally no need to re-test application
- Read the fine release notes!
  - PG 14.4 index corruption issue
    - Needed REINDEX for some cases
  - PG 14.4 security vuln fix
    - Could affect `pg_trgm` extension users

Minor release upgrades

How to upgrade

- No dump / restore needed
- (Minimal) downtime required
- Stop Postgres server
- Install new binaries
  - Usually via distribution’s package manager
- Restart Postgres

Major version upgrades

What they involve

- More complex!
  - Risk to application availability, behaviour
- Changes to internal system tables
  - `pg_catalog`
- Changes to data files format
  - Not binary compatible
- Don’t upgrade to a release that is not current
  - Unless there are compatibility issues with the application that can’t be addressed yet
- Read! `https://www.postgresql.org/docs/current/upgrading.html`

Major version upgrades

What to test

- Extensions used
  - For compatibility with the new major version
- Deprecated / removed features
  - If your application depends on them
- Beware of changes to `pg_catalog`
  - `information_schema` however is stable (SQL standard)
  - Mostly used by database management tools
- How long the upgrade will take to complete
  - `pg_upgrade` is highly dependent on number of DB objects
  - For `pg_dump(all)` factor in the data copy time
- Set up application environments with old and new PG versions

Major version upgrades

pg_dumpall

- Dump / reload
- Quiesce writes (for obvious reasons)
- `pg_dumpall > dumpfile` from old version
- `psql -d postgres -f dumpfile` in new version
- Upgrade via logical backup
- Needs disk space
- Takes time to export / import data

Major version upgrades

pg_upgrade

- In-place upgrade
- Stop Postgres server
- `pg_upgrade -b oldbindir -d oldconfigdir -D newconfigdir`
- Has `--check` option to perform a rudimentary dry run
- Can be performed in minutes or even seconds when using `--link`
- `--jobs` option for number of parallel jobs

Major version upgrades

Logical replication upgrades

- Replicate from old version directly to new version server
  - If switchover carefully orchestrated with pgbouncer, etc.
- Near-zero downtime upgrade
- No binary compatibility needed
- Can be performed with “native” LR or external solutions
  - pglogical, Slony-I, Londiste, Bucardo, ...

What works great or better than other DBs

What works great

Or better than other DBs

- Minor release upgrades are extremely reliable
- So are `pg_upgrades` (provided your system doesn't have much weirdness)
- `--link` or `--clone` can be significantly faster than other DBs' upgrade methods
- Full backward compatibility is supported everywhere
  - Clients, tools, and libraries can always connect to a previous version with no problems
  - Sometimes even forward compatibility is possible (but taking care to avoid new features)
- Logical replication gives an alternate upgrade path, and can be near-zero downtime
- Oracle upgrades also change internal table structure
- Oracle upgradability is between arbitrary close versions, and skipping is strongly discouraged
- MySQL upgrades cannot skip versions, upgrading from development (non-GA) versions not possible
- Mongo, MySQL, Oracle and other DBs suffer from driver compatibility issues between versions

Pain points and suggested improvements

Pain points

pg_dumpall

- Need to recreate all indexes
- Need to ANALYZE all tables

pg_upgrade

- Loses optimizer statistics so you need to ANALYZE tables
- Breaks all logical replication slots so you need to orchestrate and recreate
- Doesn't always detect all errors with --check or verify that all extensions are upgradable

Logical replication upgrades

- walsender is single threaded (consider heavy traffic DB)
- Apply process also single threaded

Other general issues

- Upgrading systems which have physical streaming replicas
- Cluster awareness (in a HA context)

Suggested improvements

- Upgrade tool warns you about incompatibilities
- Upgrade tool explains the steps required for minor release upgrade
  - Or even takes you automatically through them
- Upgrade tool gives you estimated time and disk space required
- True zero-downtime upgrades not possible with vanilla Postgres
- Avoid wait for flushing buffers at checkpoint to perform server restart?
- Keep queries running during upgrade?
- Cluster awareness and information tooling?

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  - Lætitia Avrot (Field CTO, EDB)
  - Andreas Scherbaum (Head of Databases, Adjust GmbH)
- Go watch their panel discussion!
  https://youtu.be/kgO_ms0o22E

Finally...

- Keep your Postgres updated!
- New features and improvements make it worth it
- Upgrades are reliable and mostly straightforward
- The alternative is worse!
- Postgres needs improved tooling, that's easier to use
- Don't forget to upgrade your OS as well

Thank you!

Find me on Twitter: @vyruss

Photo: Sango Bay, NW Highlands, Scotland

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