Upgrade your PostgreSQL Database: Why and how?

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About me

- ## Who is this guy?

  - Using PostgreSQL since 1998.

  - Responsible for PostgreSQL YUM repository (http://yum.PostgreSQL.org) where we host 110+ software

  - Fedora / CentOS packager for 50+ packages.

    - Used to break website, but recently gave up (until I can do more Python)

  - Working at EnterpriseDB.

  - Istanbul, Turkiye.

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Social media

- Please tweet!
    - #PostgreSQL
    - #PGDayUK16 ← Official hashtag

PostgreSQL version numbers

- Current: 2 digit major, 1 digit minor
  - 9.5.3 : 3rd minor version of 9.5 (major version)

- Upcoming: 1 digit major, 1 digit minor
  - 10.0, 10.1, (or 10.0.0, 10.0.1)

  - 11.0, 11.1 (or 11.0.0, 11.0.1)

  - Avoids confusion (no more "I'm using PostgreSQL 9")

- Major version incompatibilities

- Changes between minor versions and changes between major versions.

Minor version updates

- Stays on the same major version:
  - 9.5.2 → 9.5.3

- Easy!

- Package manager?
  - Automatic restart!

- In general, a restart is enough, rarely requires extra attention.
  - Release notes!

  - http://www.postgresql.org/docs/devel/static/release.html

Major version upgrades

- Changes the major version:
  - 9.4.7 → 9.5.3

- Data files are not compatible

- Needs some attention

- This talk is mostly about major version upgrades!

Issues

- Time (downtime)

    – Who loves it?

- Application compatibility

- Extension compatibility: Check before starting upgrade process

- (Lifetime) support

    – PGDG supports 5 releases.

- Platform changes

- ...

Why should you keep up2date?

- Security fixes

- Bug fixes

  - Sometimes fixes to avoid data loss or corruption.

- New features (only for major releases)

- Platform support

- Lifetime support

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So, how to perform the upgrades?

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Installing new major version

- Sure, we need to install the new major version first!

- First step: Install the new major version.

- Source code installation: Use a new directory

- Package installation: Depends
  - Debian/Ubuntu: Allows parallel major version installation
  - Red Hat/Fedora own RPMs: Only one major version, but supports upgrading.
    - Recently more than one major version available, but still not parallel.
  - PGDG RPMs: Allows parallel major version installation
  - Windows: Allows parallel major version installation

The old school way: Dump and restore

- Supposed to work all the times
    - Except when the data is corrupt

        - Duplicate constraints, etc.

- pg_dump or pg_dumpall
    - Parallel pg_dump in 9.3+: Not a big gain for large data sets.

- Tip: Use pg_dump of higher major version

- Cons: May take a long time.
    - pg_restore -j : May not be a big gain for large data sets.

- Pros: Works across different OSes (mostly) (usually) (well, probably).

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What about on-disk upgrade?

- pg_upgrade!
  - Not needed for minor version updates

- 9.0+

- --check (-c) option!
  - Checks binary compatibility

- Dumps and restores structures (system tables)

- link mode! (-k), Parallel mode (-j)

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What about on-disk upgrade?

- Make sure you delete old cluster and update statistics on new one.

- Pros: Fast

- Cons: No rollback!

- SR slaves: rsync

- Red Hat / Fedora: provides code for upgrading the database using pg_upgrade on OS upgrades.

- PGDG RPMs: Broken code. The RPM maintainer needs to fix it. Don't know who he/she is :P

(Trigger based) replication and upgrade

Slony, Londiste, Bucardo

- Uses triggers: Overhead (duplicate writing)

- Installation: Needs extra attention
  - Get list of all tables

  - PK requirement (should be anyway)

- Major version upgrades

- Uses separate tables to track changes

(Trigger based) replication

Slony, Londiste, Bucardo

- Less downtime (compared to pg_dump/pg_restore)

- Cons: No large object replication

- Slony: Different OS'es

- Maintenance overhead: Schema changes

- **May** take too long to sync

Logical replication framework

9.4+

- A framework for online upgrades

- "Stream the modifications performed via SQL"

- Replication slots
  - From docs: "Changes are sent out in streams identified by logical replication slots. Each stream outputs each change exactly once."

- Replication sets:
  - Per docs: "Provides a mechanism to control which tables in the database will be replicated and which actions on those tables will be replicated."

- Much performant than trigger based solutions!

- Allows per-database (or table, etc.) replication.

Logical replication framework

9.4+

- Works across different platforms (PPC on Linux to x86_64 on OS-X) .

- Works only with streaming, not archiving of WAL files.

- Compatibility issues?

- Faster in 9.5+

- wal_level = logical

- Does not (yet) replicate DDL

- Still improving

Tools using logical replication

9.4+

- BDR

- pglogical

- xDB

- Slony (WIP)

Upgrading with pglogical

- pglogical: Replication *and* upgrade solution for PostgreSQL

- Open source: https://2ndquadrant.com/en/resources/pglogical/

- "Extension" to PostgreSQL, submitted for 10.0.0.0.0.0 (or whatever)

- Temp and unlogged tables cannot be replicated, so no upgrades!

- Upgrade from 9.4+ to 9.5+

Upgrading with pglogical

- No DDL replication (pglogical.replicate_ddl_command)

- shared_preload_libraries='pglogical'

- Can use track_commit_timestamps = on

- No GUI (yet?)

Upgrading with pglogical

- SELECT pglogical.create_node(

    node_name := 'pgdayuk16',

    dsn := 'host=masternode port=5432 dbname=pgdayuk2016'

  );

- Add all tables in a schema:
    - SELECT pglogical.replication_set_add_all_tables('default', ARRAY['public']);

- Tip: Try creating replication sets before subscribing: Saves time in initial replication (not a must).

Upgrading with pglogical

- Subscriber

- SELECT pglogical.create_node…

- SELECT pglogical.create_subscription ...

Upgrading with pglogical

Finishing the upgrade

- Shut down master

- Redirect your apps to new server

- Use a middleware!

Upgrading with xDB

- xDB: Replication *and* upgrade solution for PostgreSQL and PPAS.

- A product by EnterpriseDB:

  http://www.enterprisedb.com/products-services-training/products-overview/xdb-replication-server-multi-master

- Temp and unlogged tables cannot be replicated, so no upgrades!

- Upgrade from 9.4+ to 9.5+

- Nice GUI, also a command line option.

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Upgrading with xDB

- DDL replication:

  - Explicitly execute DDL command via xDB (using GUI "Replicate DDL" option or Rep CLI "replicateDDL" command)

  - Example: To add a new column in published table, choose "Replicate DDL" option on MDN node, and xDB will apply it.

- Option for Trigger based upgrades

  - 9.1+

- No patches needed to PostgreSQL or PPAS.

- Requires test_decoding extension on publication node (for single master replication) or on all nodes (for multi master replication)

Upgrading with xDB

- Setting up replication with GUI:

    - Publisher node

    - Subscriber node

    - Select tables

    - Start replication

- Conflict resolution

Lessons learned:

- Always keep your servers up2date!

  - Minor version updates are relatively cheap

- Upgrade to a new major version to use new features. Do it. Use it, test it!

- pg_dump is not good for large databases

- Keep downtime minimal

- Test, test, test!

Questions, comments?

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