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# Database Version Control

*Release 0.6.2*

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# DVC

Version control your database!



*DVC to version control your database!*



## INTRODUCTION

### 1.1 What is Version Control?

In its most general sense, Version Control means to track and manage the different versions of a document or set of documents. While it is mostly practised in the world of software engineering, its use cases also abound in other areas. For instance, book writers often benefit from version controlling their drafts. This enables them to explore different writing styles, themes and so on. Failed attempt in a certain direction can be safely scrapped while the writer jumps back to the version he is most comfortable in.

### 1.2 What is Software Version Control?

As mentioned, software engineering practices version control heavily. Unlike hardware, software has high malleability. This makes it necessary to keep track of the changes made to the software and to have the ability to jump back to the prior version when the latest version breaks. The current industry standard for Software Version Control is Git, a distributed version control system created by Linux Torvald. It has superseded its predecessors like SVN, which is a local version control system which stores a project's history in a single server.

### 1.3 What is Database Version Control?

Interestingly, while there is much discussion around Software Version Control, there seems to be a lack of discussion around database version control. Database, especially Relational Database Management System (RDBMS), does not merely store data. It also stores, among others, data about data (metadata, like DDL) and user access privileges (DCL). Given that a lot of applications are data-driven, which means the software's behaviour is affected by the data which it receives, version controlling your database should not come off as secondary to version controlling your software.

Examples of Existing Database Version Control Systems in the market

### 1.4 Existing Database Version Control Tools

There are a number of existing database version control tools.

### 1.4.1 Commercial

Examples which are commercial and written in java.

- flyway
- liquibase

### 1.4.2 Open Source

In the python world, we have the below open-source products.

- alembic
- yoyo-migration

## 1.5 Personal experience

I have experimented with both alembic and yoyo-migration, but found the following shortcomings:

### 1.5.1 alembic

The metadata is mostly stored as files in the repository, and NOT as an entry in the database.

It makes it difficult to directly query the database for its current version.

### 1.5.2 yoyo-migration

The SQL migration files must be prefixed with numbers left padded with zeros.

For instance, '0001\_\_description.sql'. If we have more than 1000 SQL files, then we probably need to rename the old files (e.g. to '00001\_\_description.sql'). However, given that file names must be immutable in order for the database version control system to work properly, it means that it always has an upper limit as to how many SQL migration files you can have.

### 1.5.3 Goal of a custom database version control tool

This makes me want to create my own version of database version control system (DVC).

My own database version control system in python: Design Requirements

My goal is to have a DVC satisfying the below requirements:

- It works only with the Postgresql database (Optionally, it should be extendable)
- It accepts only SQL files (It does not use ORM, like SQLAlchemy)
- It retains rich metadata in the database, so that we can check the database version via SQL.
- The spirit is that the DVC should act like *git*, which stores all the git objects in a *.git* folder. Similarly, there should be a table in the database, which stores all the metadata of the DVC, such that a simple SQL can be used to query the database version.



## FEATURES

This page explains the features of the CLI.

## 2.1 Overview

### 2.1.1 Command Line Interface

- Showing CLI commands.

### 2.1.2 Rich Database Metadata

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**Note:** More information about the metadata can be found under [design/metadata](#)

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- **Showing the metadata tables.**
  - `dvc.database_revision_history` table which shows the revision SQL files applied.
  - `dvc.database_version_history` table which shows the database version which results from the revision SQL files applied.

### 2.1.3 Upgrade or Downgrade

- **Showing upgrade and downgrade command.**
  - Started from database version 1 (Shown via *dvc db current*)
  - Showed the Revision SQL files under the default folder *sample\_revision\_sql\_files*.
  - Applied database upgrade via *dvc db upgrade*.
  - Showed the database version became 2.
  - Applied database downgrade via *dvc db downgrade*.
  - Showed the database version was back to 1.

## 2.1.4 Flexible Configuration Format

Configuration is read either from i. Configuration File (config.yaml) or ii. Environment Variable

### Configuration File

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**Note:** The configuration file template can be generated via `dvc cfg init`

---

- Showing dvc tool reads configuration from a configuration file.
  - Ran a postgres DB via docker `docker run -e POSTGRES_USER=test -e POSTGRES_PASSWORD=test -e POSTGRES_DB=test -p 5433:5432 postgres:latest`
  - Copied a `config.yaml` file with configurations which match the spun up postgres DB.
  - Pinged the DB with `dvc db ping`. Success!
- The config.yaml file looks as follows:

```
credentials:
  dbflavour: postgres
  dbname: 'test'
  host: 'localhost'
  password: 'test'
  port: 5433
  user: 'test'
database_revision_sql_files_folder: sample_revision_sql_files
logging_level: DEBUG
```

### Environment Variable

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**Note:** The names of the environment variables can be found in the [docker compose file](#)

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- Showing dvc tool reads configuration from environment variables
  - Ran a postgres DB via docker `docker run -e POSTGRES_USER=test -e POSTGRES_PASSWORD=test -e POSTGRES_DB=test -p 5433:5432 postgres:latest`
  - Loaded the env variables to the shell.
  - Pinged the DB with `dvc db ping`. Success!
- The environment variables look as follows:

```
>>> printenv | grep DVC
DVC__DATABASE_REVISION_SQL_FILES_FOLDER=sample_revision_sql_files
DVC__USER=test
DVC__PASSWORD=test
DVC__HOST=postgres_db
DVC__PORT=5432
DVC__DBNAME=test
DVC__DBFLAVOUR=postgres
DVC__LOGGING_LEVEL: DEBUG
```

## 2.2 Demo Files

- This page shows the SQL files used for the demonstration.

### 2.2.1 RV1

#### Upgrade

```

1  -- create schema
2  CREATE SCHEMA IF NOT EXISTS fundamentals;
3  -- create table
4  CREATE TABLE IF NOT EXISTS fundamentals.source
5  (
6      source_id INTEGER PRIMARY KEY,
7      source VARCHAR(50) NOT NULL UNIQUE,
8      created_at TIMESTAMP NOT NULL DEFAULT (now() at time zone 'utc'),
9      CONSTRAINT source_ux UNIQUE (source)
10 );
11 -- Initialise with pre-set source
12 INSERT INTO fundamentals.source (source_id, source)
13 VALUES (1, 'yahoo'), (2, 'investing_dot_com') on conflict do nothing;
14 -- create table
15 CREATE TABLE IF NOT EXISTS fundamentals.price
16 (
17     ticker VARCHAR(10) NOT NULL,
18     date DATE NOT NULL,
19     open NUMERIC(50,10) NOT NULL CHECK (open >=0),
20     high NUMERIC(50,10) NOT NULL CHECK (high >=0),
21     low NUMERIC(50,10) NOT NULL CHECK (low >=0),
22     close NUMERIC(50,10) NOT NULL CHECK (close >=0),
23     adj_close NUMERIC(50,10) NOT NULL CHECK (adj_close >=0),
24     volume NUMERIC(50,10) NOT NULL CHECK (volume >=0),
25     source_id INTEGER,
26     created_at TIMESTAMP NOT NULL DEFAULT (now() at time zone 'utc'),
27     updated_at TIMESTAMP NOT NULL DEFAULT (now() at time zone 'utc'),
28     PRIMARY KEY (ticker, date),
29     CONSTRAINT fk_source FOREIGN KEY(source_id) REFERENCES fundamentals.source(source_
↪ id) ON DELETE CASCADE
30 );

```

#### Downgrade

```

1  drop schema fundamentals cascade;

```

## 2.2.2 RV2

### Upgrade

```
1 create schema if not exists datetime;
2 create table if not exists datetime.special_date(
3     date date primary key,
4     is_hk_public_holiday boolean default False,
5     created_at TIMESTAMP NOT NULL DEFAULT (now() at time zone 'utc'),
6     updated_at TIMESTAMP NOT NULL DEFAULT (now() at time zone 'utc')
7 );
```

### Downgrade

```
1 drop schema datetime cascade;
```

## 2.2.3 RV3

### Upgrade

```
1 create or replace view datetime.vw_trading_days_since_2021 as with weekdays (weekday) as
↳ (
2 select
3     dt
4     -- Set timezone of now() to UTC
5 from
6     generate_series('2021-01-01':: date, now() at time zone 'utc', '1 day'::
↳ interval) dt
7 where
8     extract(dow
9 from
10    dt) not in (6, 0)
11    ),
12    hk_holidays (hk_holiday) as (
13 select
14     date
15 from
16     datetime.special_date sd
17 where
18     is_hk_public_holiday = true
19    ),
20 trading_days (trading_day) as (
21 select
22     weekday
23 from
24     weekdays
25 except
26 select
27     hk_holiday
```

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```
28 from
29     hk_holidays)
30 select
31     trading_day
32 from
33     trading_days
34 order by
35     trading_days ;
```

## Downgrade

```
1 drop view if exists datetime.vw_trading_days_since_2021;
```

## 2.3 Step-by-step Guide

- This page explains how the CLI can be used

### 2.3.1 Check version

```
/home/ken $ dvc version
WARNING:root:Cannot find logging_level. Using default INFO
0.4.0
```

### 2.3.2 Initialise configuration File

```
/home/ken $ dvc cfg init
WARNING:root:Cannot find logging_level. Using default INFO
INFO:root:Now generating default config file config.yaml
INFO:root:Reading config from file...
INFO:root:Generating database revision folder
```

### 2.3.3 Create Test Database

```
/home/ken $ psql -U postgres
psql (14.3)
Type "help" for help.

postgres=# create database my_test_db;
CREATE DATABASE
postgres=# exit
```

### 2.3.4 Create Test Database

```
/home/ken $ vim config.yamlA
1 credentials:-
2  ..dbflavour:.postgres-
3  ..dbname:..my_test_db'-
4  ..host:..localhost'-
5  ..password:..xxxxx
6  ..port:..5432-
7  ..user:..postgres'-
8 database_revision_sql_files_folder:..sample_revision_sql_files-
9 logging_level:..INFO-
~
```

### 2.3.5 Populate sample\_database\_revision\_files\_folder

```
/home/ken $ ls ./sample_revision_sql_files
RV1__create_scm_fundamentals_and_tbls.downgrade.sql
RV1__create_scm_fundamentals_and_tbls.upgrade.sql
RV2__create_scm_datetime_and_tbls.downgrade.sql
RV2__create_scm_datetime_and_tbls.upgrade.sql
RV3__datetime__create_vw_trading_days_since_2021.upgrade.sql
RV3__datetime__drop_vw_trading_days_since_2021.downgrade.sql
```

### 2.3.6 Ping the database

```
/home/ken $ dvc db ping
INFO:root:Reading config from file...
Database connection looks good!
Database: my_test_db
Host: localhost
```

### 2.3.7 Initialise the database

```
/home/ken $ dvc db init
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Database init successful!
Database: my_test_db
Host: localhost
```

### 2.3.8 Check Current Database Version

```
/home/ken $ dvc db current
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Database Current Version: V0
```

### 2.3.9 Do Dry-run for db upgrade

- Check the logs to console and ensure the SQL file to be applied is really the correct one.

```
/home/ken $ dvc db upgrade --dry-run
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Current Database Version is V0
Next Upgrade Revision Version will be 1
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Below files will be applied:
[File Path: sample_revision_sql_files/RV1__create_scm_fundamentals_and_tbls.upgrade.sql]
INFO:root:Dry run is complete
Aborted!
```

### 2.3.10 Run DB Upgrade

- Upgrade the DB and check the db version afterwards

```
/home/ken $ dvc db upgrade
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Current Database Version is V0
Next Upgrade Revision Version will be 1
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Below files will be applied:
[File Path: sample_revision_sql_files/RV1__create_scm_fundamentals_and_tbls.upgrade.sql]
Going to apply file File Path: sample_revision_sql_files/RV1__create_scm_fundamentals_
↪and_tbls.upgrade.sql .....
You sure you want to continue ? [y/N]: y
INFO:root:Now applying sample_revision_sql_files/RV1__create_scm_fundamentals_and_tbls.
↪upgrade.sql and marking to metadata table
INFO:root:Reading config from file...
INFO:root:Reading config from file...

/home/ken $ dvc db current
INFO:root:Reading config from file...
```

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```
INFO:root:Reading config from file...
Database Current Version: V1
```

### 2.3.11 Use `--head`

- Check the SQL file(s) to be applied with the `--head` flag

```
/home/ken $ dvc db upgrade --head
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Current Database Version is V1
Next Upgrade Revision Version will be 2
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Below files will be applied:
[File Path: sample_revision_sql_files/RV2__create_scm_datetime_and_tbls.upgrade.sql,
↪File Path: sample_revision_sql_files/RV3__datetime__create_vw_trading_days_since_2021.
↪upgrade.sql]
Going to apply file File Path: sample_revision_sql_files/RV2__create_scm_datetime_and_
↪tbls.upgrade.sql .....
You sure you want to continue ? [y/N]: y
INFO:root:Now applying sample_revision_sql_files/RV2__create_scm_datetime_and_tbls.
↪upgrade.sql and marking to metadata table
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Going to apply file File Path: sample_revision_sql_files/RV3__datetime__create_vw_
↪trading_days_since_2021.upgrade.sql .....
You sure you want to continue ? [y/N]: y
INFO:root:Now applying sample_revision_sql_files/RV3__datetime__create_vw_trading_days_
↪since_2021.upgrade.sql and marking to metadata table
INFO:root:Reading config from file...
INFO:root:Reading config from file...
```

### 2.3.12 Use `--head`

- Check the result in the database

```
/home/ken $ psql -U postgres -d my_test_db
psql (14.3)
Type "help" for help.

my_test_db=# select * from information_schema.tables where table_schema not in (
↪'information_schema', 'pg_catalog');
 table_catalog | table_schema |      table_name      | table_type | self_
↪referencing_column_name | reference_generation | user_defined_type_cata
log | user_defined_type_schema | user_defined_type_name | is_insertable_into | is_typed_
↪| commit_action
```

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-----+-----+-----+-----+-----					
↪-----+-----+-----+-----+-----					
↪+-----+-----+-----+-----+-----					
my_test_db	dvc	database_revision_history	BASE TABLE		
			YES	NO	
my_test_db	dvc	database_version_history	BASE TABLE		
			YES	NO	
my_test_db	fundamentals	source	BASE TABLE		
			YES	NO	
my_test_db	fundamentals	price	BASE TABLE		
			YES	NO	
my_test_db	datetime	special_date	BASE TABLE		
			YES	NO	
my_test_db	datetime	vw_trading_days_since_2021	VIEW		
			NO	NO	
(6 rows)					

### 2.3.13 Downgrade the database with `--base` and `--no-confirm`

- Check the result in the database

```

/home/ken $ dvc db downgrade --base --no-confirm
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Current Database Version is V3
Next Downgrade Revision Version will be 3
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Below files will be applied:
[File Path: sample_revision_sql_files/RV3__datetime__drop_vw_trading_days_since_2021.
↪downgrade.sql, File Path: sample_revision_sql_files/RV2__create_scm_datetime_and_tbls.
↪downgrade.sql, File Path: sample_revision_sql_files/RV1__create_scm_fundamentals_and_
↪tbls.downgrade.sql]
Going to apply file File Path: sample_revision_sql_files/RV3__datetime__drop_vw_trading_
↪days_since_2021.downgrade.sql .....
INFO:root:Now applying sample_revision_sql_files/RV3__datetime__drop_vw_trading_days_
↪since_2021.downgrade.sql and marking to metadata table
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Going to apply file File Path: sample_revision_sql_files/RV2__create_scm_datetime_and_
↪tbls.downgrade.sql .....

```

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```

INFO:root:Now applying sample_revision_sql_files/RV2__create_scm_datetime_and_tbls.
↳downgrade.sql and marking to metadata table
INFO:root:Reading config from file...
INFO:root:Reading config from file...
Going to apply file File Path: sample_revision_sql_files/RV1__create_scm_fundamentals_
↳and_tbls.downgrade.sql ....
INFO:root:Now applying sample_revision_sql_files/RV1__create_scm_fundamentals_and_tbls.
↳downgrade.sql and marking to metadata table
INFO:root:Reading config from file...
INFO:root:Reading config from file...

```

### 2.3.14 Check Database tables again

- Check the result in the database

```

/home/ken $ psql -U postgres -d my_test_db
psql (14.3)
Type "help" for help.

my_test_db=# select * from information_schema.tables where table_schema not in (
↳'information_schema', 'pg_catalog');
  table_catalog | table_schema |      table_name      | table_type | self_
↳referencing_column_name | reference_generation | user_defined_type_catal
og | user_defined_type_schema | user_defined_type_name | is_insertable_into | is_typed |
↳commit_action
-----+-----+-----+-----+-----+-----+-----+-----+
↳-----+-----+-----+-----+-----+-----+-----+
-- +-----+-----+-----+-----+-----+-----+-----+
↳-----+-----+-----+-----+-----+-----+-----+
my_test_db | dvc          | database_revision_history | BASE TABLE |
↳
|              |                  | YES                  | NO          |
my_test_db | dvc          | database_version_history | BASE TABLE |
↳
|              |                  | YES                  | NO          |
(2 rows)

my_test_db=# \pset format wrapped
Output format is wrapped.
my_test_db=# select * from dvc.database_revision_history;
 revision_id | executed_sql_file_folder |      executed_sql_file_name      | executed_sql_
↳file_content_hash | executed_sql_file_content | operation | revision_applied |
↳created_at
-----+-----+-----+-----+-----+-----+-----+
↳-----+-----+-----+-----+-----+-----+-----+
↳-----+-----+-----+-----+-----+-----+-----+
1 | sample_revision_sql_file. | RV1__create_scm_fundamentals_. |
↳0f76966869d3d4eb2d3511f1dcd6f6. | -- create schema          +| Upgrade   | RV1
↳ | 2022-06-25 09:56:53.161.
| .s | .and_tbls.upgrade.sql | .1d
↳
| CREATE SCHEMA IF NOT EXIS. |

```

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```

→      |      |.TS fundamentals;      |      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      | -- create table      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      | CREATE TABLE IF NOT EXIST.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |.S fundamentals.source      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      | (      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      | source_id INTEGER PR.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |.IMARY KEY,      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      | source VARCHAR(50) N.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |.OT NULL UNIQUE,      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      | created_at TIMESTAMP.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |. NOT NULL DEFAULT (now() .|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |.at time zone 'utc'),      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      | CONSTRAINT source_ux.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |. UNIQUE (source)      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      | );      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      | -- Initialise with pre-se.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |.t source      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      | INSERT INTO fundamentals..|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |.source (source_id, source.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      ||..)      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      | VALUES (1, 'yahoo'), (2, .|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      |.'investing_dot_com') on c.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |.onflict do nothing;      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      | -- create table      |      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      | CREATE TABLE IF NOT EXIST.|      |      |      |
→      |      |      |      |      |      |      |      |
→      |      |      |      |      |.S fundamentals.price      |      |      |      |

```

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[illegible]

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```

3 | sample_revision_sql_file.| RV3__datetime__create_vw_trad.|
ffe591a58e951e7bbe87b0c06b7d8c.| create or replace view da.| Upgrade | RV3
| 2022-06-25 09:59:01.832.
|.s|.ing_days_since_2021.upgrade.s|.fa|.872
|.etime.vw_trading_days_si.||.ql|.
|.nce_2021 as with weekdays.||.
|. (weekday) as ( +||.
| select +||.
| dt +||.
| -- Set timezone of now() .||.
|.to UTC +||.
| from +||.
| generate_series('.||.
|.2021-01-01':: date, now().||.
|. at time zone 'utc', '1 d.||.
|.ay':: interval) dt +||.
| where +||.
| extract(dow +||.
| from +||.
| dt) not in (6, 0)+||.
| ), +||.
| hk_holidays (hk_h.||.
|.oliday) as ( +||.
| select +||.
| date +||.
| from +||.
| datetime.special_||.
|.date sd +||.
| where +|

```

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↪			is_hk_public_holi.				↪
↪			.day = true	+			↪
↪			),	+			↪
↪			trading_days (trading_day.				↪
↪			.) as (	+			↪
↪			select	+			↪
↪			weekday	+			↪
↪			from	+			↪
↪			weekdays	+			↪
↪			except	+			↪
↪			select	+			↪
↪			hk_holiday	+			↪
↪			from	+			↪
↪			hk_holidays)	+			↪
↪			select	+			↪
↪			trading_day	+			↪
↪			from	+			↪
↪			trading_days	+			↪
↪			order by	+			↪
↪			trading_days ;				↪
↪	4		sample_revision_sql_file.		RV3__datetime__drop_vw_tradin.		↪
↪	b4fd8e1c50f3f17eab0ad8f05d2d50.		drop view if exists datet.		Downgrade		↪
↪		2022-06-25 10:09:41.442.			RV3		↪
↪		.s		.g_days_since_2021.downgrade.s.		.b1	↪
↪		.ime.vw_trading_days_since.				.939	↪
↪				.ql			↪
↪			.2021;				↪
↪	5		sample_revision_sql_file.		RV2__create_scm_datetime_and.		↪
↪	d040183e1231b5e4e82f0c7e4133d0.		drop schema datetime casc.		Downgrade		↪
↪		2022-06-25 10:09:41.471.			RV2		↪
↪		.s		.tbls.downgrade.sql		.c6	↪
↪		.ade;				.216	↪

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6		sample_revision_sql_file.		RV1__create_scm_fundamentals_.			
↪		f28acbf63e26ece3c0324a9cd74dd2.		drop schema fundamentals .		Downgrade	RV1
↪		2022-06-25 10:09:41.493.					
		.s		.and_tbls.downgrade.sql		.87	
↪		.cascade;				.714	



## QUICKSTART

### 3.1 Executable

---

**Note:** Executables are available on [Github Releases](#)

---

- The releases page provides executables on the below three Operating Systems.
  - Mac (Latest)
  - Linux Ubuntu (Latest)
  - Windows (Latest)

if you happen to use one of the OSes listed above, you can download the executable directly and use it without installing python!

### 3.2 PyPI Library

---

**Note:** The commandline tool is uploaded to [PyPI](#)

---

Run the below to see it in action.

```
# Install the library from PyPi
pip install database-version-control

# To get more instructions of the commandline tool, run the below in the terminal
dvc --help
```

See detailed deployment of the [commandline tool](#)

## 3.3 Docker Image

---

**Note:** The tool is containerised and is distributed on [Dockerhub](#)

Check out the *docker-compose.yml* file in the [github repository](#) to run a demo!

---

Run the below to see it in action.

```
# Clone the repo and checkout release branch
git clone git@github.com:kenho811/Python_Database_Version_Control.git

# cd to the repository
cd Python_Database_Version_Control/docker_compose_demo

# Fnd the docker-compose.yml and run
docker compose up

# Using psql as client, access the postgres DB and see the result
(URL: postgres://test:test@localhost:5433/test)
PGPASSWORD=test psql -U test -d test -h localhost -p 5433

# Check out docker-compose.yml file for usage as a microservice
```

See detailed deployment of the [Docker Image](#)

## DEPLOYMENT

This page explains how the tool can be deployed.

### 4.1 Docker Image

This page explains how to use the tool packaged in a Docker Image.

#### 4.1.1 Docker compose

- *Docker Compose* allows spinning up several containers together as a single service.
- Configurations are stored in a *docker-compose.yml* file.
- For illustration, please refer to the [docker-compose.yml](#) file.

#### 4.1.2 Kubernetes

- TBC

### 4.2 CLI

This page explains how to use the tool packaged as commandline tool (CLI).

It is easier to use a configuration file than environment variables.

A typical workflow is as follows:

```
# Generate configuration file
dvc cfg init

# Update the generated config.yaml

# Test connection to the database with the updated config.yaml
dvc db ping

# Create a folder to store all the SQL files to be applied to the database
# Remember to use the same folder name as specified in the config.yaml file
```

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```
# Make sure the SQL files follow the naming conventions.

# Run upgrade script
dvc db upgrade

# (Optional) To revert the migration, create a downgrade script and run it
dvc db downgrade

# (Optional) Check the current database version
dvc db current
```

This page explains the design of the tool

## 5.1 Overview

This page explains gives a graphical overview of the tool.

### 5.1.1 DVC CLI commands and subcommands

This section explains the client-facing side of the tool. The library is exposed via the commandline *dvc*.

### 5.1.2 Data Structures

#### Core Structure

This section explains the core of the tool. It shows the interaction between the classes (marked in *yellow*). Greyed out items are features yet to be implemented.

#### DatabaseVersion and DatabaseRevisionFile

- Below is a series of graphs illustrating the relationship between
  - Current Database Version (DatabaseVersion)
  - Target Database Version (DatabaseVersion)
  - One or more Database Revision Files (DatabaseRevisionFiles)

## 5.2 Configuration

- **Two ways to pass configurations to DVC tool.**
  - Via Environment Variables.
  - Via Configuration File.
- Note that **Configuration File** has precedence **OVER Environment Variables**. In other words, if a configuration file is detected by DVC tool, the environment variables will be ignored.

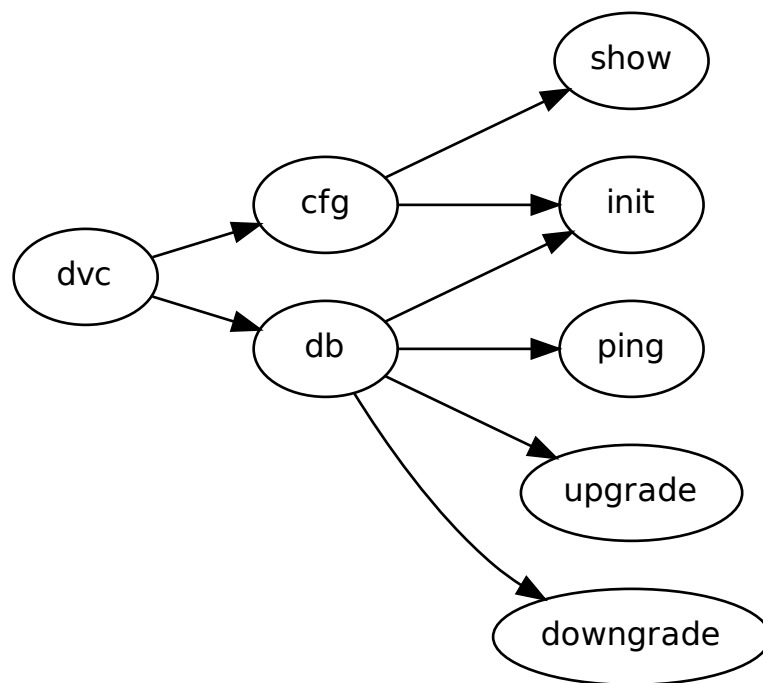


Fig. 1: DVC CLI Commands and Subcommands

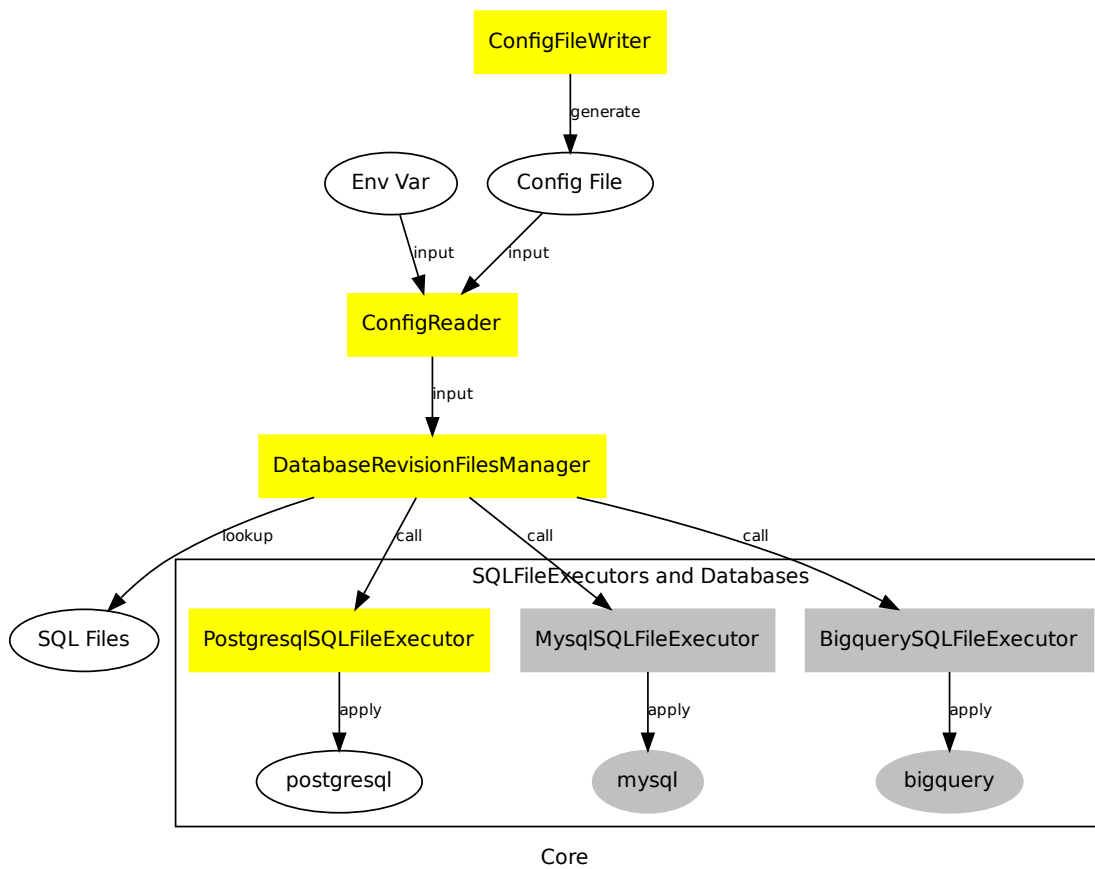


Fig. 2: DVC Core structure

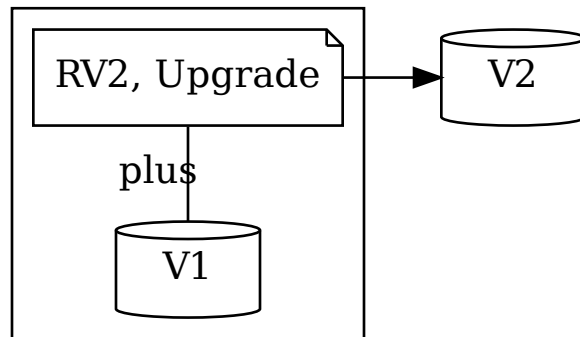


Fig. 3:  $V1 + RV2 \text{ (Upgrade)} = V2$

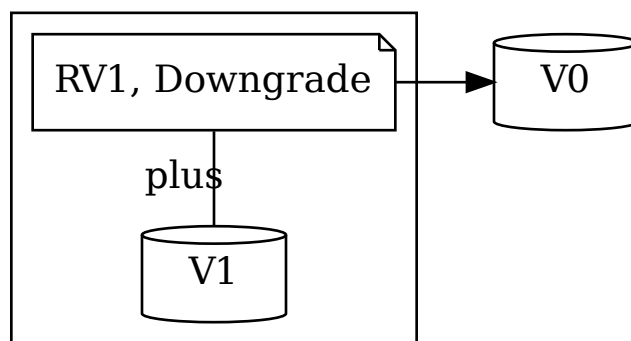


Fig. 4:  $V1 + RV1 \text{ (Downgrade)} = V0$



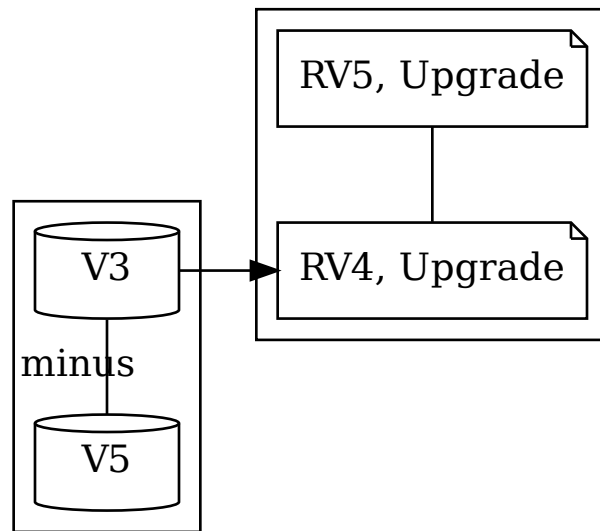


Fig. 5:  $V5 - V3 = [RV4 \text{ Upgrade} + RV5 \text{ Upgrade}]$

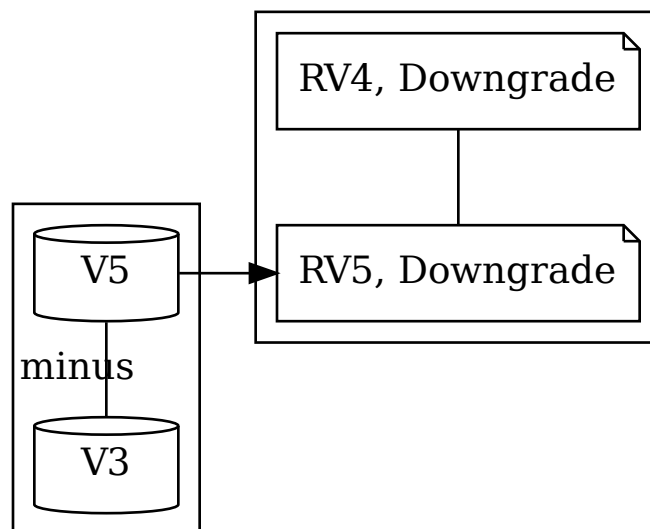


Fig. 6:  $V3 - V5 = [RV5 \text{ Downgrade} + RV4 \text{ Downgrade}]$

## 5.3 Revision SQL files Naming Convention

The tool discovers and applies SQL files to the database for version control.

These files need to follow a certain naming conventions.

- All SQL files are considered *revision files*
- They must follow the pattern *RV[0-9]\*\_\_.\*(upgrade|downgrade).sql*. In words, it means
  - They start with the prefix *RV*
  - After *RV*, it follows an arbitrary revision number (e.g. RV1, RV2, RV3 etc. etc.)
  - After *RV(arbitrary\_revision\_number)*, it follows double underscores and an arbitrary number of characters. Everything after *\_\_* describes what the SQL file does.
  - After *RV(arbitrary\_revision\_number)\_\_(description)*, it follows a dot and the character group of either *upgrade* or *downgrade*. When applied, an upgrade revision file will move the database version upward by 1, while a downgrade revision file will move the database version downward by 1.
  - After *RV(arbitrary\_revision\_number)\_\_(description).(upgrade/downgrade)*, it follows a dot and the character group of *sql*.
  - Overall, *RV(arbitrary\_revision\_number)\_\_(description).(upgrade/downgrade).sql*
- Example SQL revision files
  - RV1\_\_create\_scm\_company\_secrets\_and\_tbl\_earnings.upgrade.sql
  - RV1\_\_delete\_scm\_company\_secrets\_cascade.downgrade.sql
  - RV2\_\_alter\_scm\_company\_secrets\_tbl\_earnings\_updated\_at\_add\_index.upgrade.sql
  - RV2\_\_alter\_scm\_company\_secrets\_tbl\_earnings\_updated\_at\_remove\_index.downgrade.sql

## 5.4 Database Metadata

Just like git which stores all the metadata in a dot git folder (.git), the tool also stores metadata in the database where SQL Revision Files are applied.

- Schema dvc will be created
  - **Table dvc.database\_revision\_history will be created.**
    - \* History of revision SQL files applied.
  - **Table dvc.database\_version\_history will be created.**
    - \* History of database versions which result from revision SQL files applied.

## CONTRIBUTION

This page explains how to contribute to the codebase.

### 6.1 Development and Release Workflow

This page explains the development/release workflow.

It follows the model of [Release Branching Strategy](#)

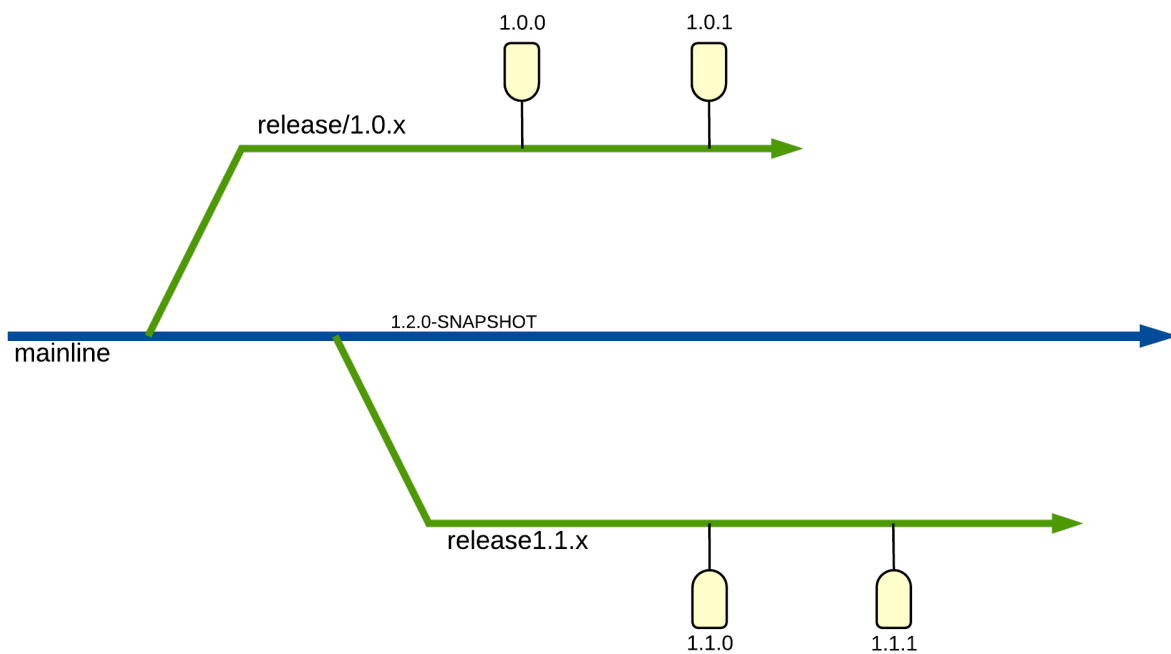


Fig. 1: Sourced from <http://releaseflow.org/>

## 6.1.1 Development - Add new features

In General,

- Create a feature branch from master. Call it *feature/{theme}*
- Keep making changes to the feature branch until the feature is ready. Make sure it passes all automated tests.
- Merge it to master branch after it's complete.

```
# Git clone the repo and checkout master
git clone -b master git@github.com:kenho811/Python_Database_Version_Control.git

# create a feature branch from the master branch
git checkout -b feature/{theme}

# Pip install dependencies
pip install with `pip install ".[dev]"`

# Development

# Write unit + integration tests

# Run pytest
pytest

# Generate Documentation locally. ISLOCAL=1 removes local dependencies.
cd docs
ISLOCAL=1 make clean html

# Open PR against master
```

## 6.1.2 Release - Make App available for deployment

In General,

- Do a code-cut from the master branch.
- Name the new branch *release/{major.minor}*
- Create a tag based on the new branch *release{major.minor.patch}*

```
# Review and merge PR into master branch

# Update local master branch
git checkout master
git pull

# Update local master branch

# Update the tool's version under src/dvc/version.py
# See: https://github.com/kenho811/Python\_Database\_Version\_Control/blob/master/src/dvc/
↪ version.py#L1
# Example: __version__ = "{major.minor.patch}"
```

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```
# Cut a release branch with the same updated version number
git checkout -b release/{major.minor}
git push --set-upstream origin release/{new_version_num}

# Create a new release tag
git tag release/{major.minor.patch}
git push --tags
```

### 6.1.3 Hotfix - Fix deployment bugs

In General,

- Say the release with release tag *release/0.5.0* has bugs.
- Create a new hotfix branch from the branch *release/0.5*
- After the fix is in place, merge it against *release/0.5*
- Create a new release tag based on the latest commit at *release/0.5*. Call it *release/0.5.1*.

```
# Checkout the release branch which the problematic release tag belongs to
git checkout release/0.5

# Create hotfix branch
git branch -b hotfix/against_0.5.0

# Once done, open a PR and merge back to release/0.5

# At release/0.5 branch, update the __version__
# See: https://github.com/kenho811/Python\_Database\_Version\_Control/blob/master/src/dvc/
↪ version.py#L1
# Example: __version__ = "0.5.1"

# Create a new release tag
git tag release/0.5.1
git push --tags
```

- The CI pipeline specified [here](#) will manage the rest.

## 6.2 Continuous Integration

The Codebase is on [github](#).

CI is currently done via github action. It is integrated to the following destinations:

- [Dockerhub](#)
- [PyPI](#)
- [ReadtheDocs \(Latest\)](#)

The table below shows the details:

Table 1: CI convention for branches

Branch	Performs Tests?	Artifacts	DockerHub Tag	Push DockerHub Readme?	PyPI Version	Readthedocs Version
master	Yes	Pytest report.	latest	Yes	N/A	latest
feature/**	Yes	N/A	N/A	No	N/A	N/A
re-release/{major.minor}	Yes	N/A	N/A	No	N/A	N/A

Table 2: CI convention for tags

Tag	Performs Tests?	Artifacts	DockerHub Tag	Push DockerHub Readme?	PyPI Version	Readthedocs Version
re-release/{major.minor.patch}	Yes	Pytest artifacts + executables in github releases.	release-{major.minor.patch}	No	{major.minor.patch}	release-{major.minor.patch}

## SOURCE DOCUMENTATION

### 7.1 Src Package

#### 7.1.1 dvc package

Subpackages

dvc.app package

Subpackages

dvc.app.cli package

Subpackages

dvc.app.cli.commands package

Subpackages

dvc.app.cli.commands.database package

Submodules

dvc.app.cli.commands.database.backend module

```
class dvc.app.cli.commands.database.backend.DatabaseInteractor(config_file_path_str: str)
    Bases: object
```

Exposes API to interact with Various Database flavours

```
MAPPING = {SupportedDatabaseFlavour.Postgres: <function
DatabaseInteractor.<lambda>>}
```

```
property conn
```

Returns

```
property database_revision_files_manager:
    dvc.core.config.DatabaseRevisionFilesManager
```

Returns DatabaseRevisionFilesManager

**execute\_single\_sql\_file**(*database\_revision\_file*: [dvc.core.struct.DatabaseRevisionFile](#), *mark\_only*: *bool* = *False*) → *None*

Execute DatabaseRevisionFile to the Database and optionally mark it as metadata

### Parameters

- **database\_revision\_file** – Database Revision File to apply to the Database
- **mark\_only** – whether or not to mark the SQL file as being done as metadata, without actually executing the SQL file

### Returns

**get\_target\_database\_revision\_files**(*steps*: *int*, *pointer*: *Optional*[[dvc.core.config.DatabaseRevisionFilesManager.Pointer](#)] = *None*) → *List*[[dvc.core.struct.DatabaseRevisionFile](#)]

Helper to get target database revision files Check number of returned revision files must be same as steps specified

**Parameters** **steps** – Specify how many steps ahead/ backwards.. When *None*, it goes to the very end in either direction

**Returns** List of DatabaseRevisionFiles, if any

**property latest\_database\_version**: [dvc.core.struct.DatabaseVersion](#)

**Returns** latest Database Version

**ping()** → *None*

Ping the database connection

### Returns

**property sql\_file\_executor**

**property target\_schema**

**Returns**

## Module contents

database subcommand

## Submodules

[dvc.app.cli.commands.config module](#)

config subcommand



## Module contents

### Submodules

#### dvc.app.cli.main module

Starting point of the CLI

## Module contents

### Module contents

#### dvc.core package

### Subpackages

#### dvc.core.database package

### Subpackages

#### dvc.core.database.bigquery package

### Module contents

```
class dvc.core.database.bigquery.BigQuerySQLFileExecutor(db_conn:
                                                         psycpg2.extensions.connection,
                                                         target_schema: str)
    Bases: dvc.core.database.SQLFileExecutorTemplate
```

#### dvc.core.database.mysql package

### Module contents

```
class dvc.core.database.mysql.MySQLSQLFileExecutor(db_conn: psycpg2.extensions.connection,
                                                    target_schema: str)
    Bases: dvc.core.database.SQLFileExecutorTemplate
```

#### dvc.core.database.postgres package

### Module contents

```
class dvc.core.database.postgres.PostgresSQLFileExecutor(db_conn:
                                                         psycpg2.extensions.connection,
                                                         target_schema: str)
    Bases: dvc.core.database.SQLFileExecutorTemplate
    FILE_HASHER = <dvc.core.hash.FileHasher object>
```

```
METADATA_SQL_FOLDER_PATH =  
PosixPath('/home/docs/checkouts/readthedocs.org/user_builds/  
python-database-version-control/checkouts/latest/src/dvc/core/database/postgres')  
  
execute_database_revision(database_revision_file: dvc.core.struct.DatabaseRevisionFile)  
    Execute database revision and write to database version control tables :param database_revision_file: :re-  
    turn:  
  
get_latest_database_version() → dvc.core.struct.DatabaseVersion  
    Get the latest database version :return:  
  
set_up_database_revision_control_tables()  
    Create all database revision control schema and tables :return:
```

## Module contents

```
class dvc.core.database.SQLFileExecutorTemplate(db_conn: psycopg2.extensions.connection,  
                                                target_schema: str)  
  
    Bases: abc.ABC  
  
    Abstract Base Class for all SQLFileExecutors for different datbaases  
  
    abstract execute_database_revision(database_revision: dvc.core.struct.DatabaseRevisionFile)  
    abstract get_latest_database_version()  
    abstract set_up_database_revision_control_tables()  
  
class dvc.core.database.SupportedDatabaseFlavour(value)  
    Bases: enum.Enum  
  
    List of database flavours supported in the programme  
  
    Postgres = 'postgres'
```

## Submodules

### dvc.core.config module

```
class dvc.core.config.ConfigDefault  
    Bases: object  
  
    KEY__DATABASE_REVISION_SQL_FILES_FOLDER = 'DVC__DATABASE_REVISION_SQL_FILES_FOLDER'  
    KEY__DBFLAVOUR = 'DVC__DBFLAVOUR'  
    KEY__DBNAME = 'DVC__DBNAME'  
    KEY__HOST = 'DVC__HOST'  
    KEY__LOGGING_LEVEL = 'DVC__LOGGING_LEVEL'  
    KEY__PASSWORD = 'DVC__PASSWORD'  
    KEY__PORT = 'DVC__PORT'  
    KEY__TARGET_SCHEMA = 'DVC__TARGET_SCHEMA'  
    KEY__USER = 'DVC__USER'  
  
    VAL__DATABASE_REVISION_SQL_FILES_FOLDER = 'sample_revision_sql_files'
```

```

VAL__DBFLAVOUR = 'postgres'
VAL__DBNAME = ''
VAL__FILE_PATH: pathlib.Path = PosixPath('config.yaml')
VAL__File_NAME: str = 'config.yaml'
VAL__HOST = ''
VAL__LOGGING_LEVEL: str = 'INFO'
VAL__PASSWORD = ''
VAL__PORT = 5432
VAL__TARGET_SCHEMA = 'dvc'
VAL__USER = ''
classmethod get_config_dict(database_revision_sql_files_folder: str, target_schema: str, user: str,
                             password: str, host: str, port: int, dbname: str, dbflavour: str,
                             logging_level: int, as_file=False)

```

#### Parameters

- **database\_revision\_sql\_files\_folder** –
- **user** –
- **password** –
- **host** –
- **port** –
- **dbname** –
- **dbflavour** –
- **logging\_level** – Assumed to be integer value
- **as\_file** – whether to dump the dict as file.

#### Returns

```

class dvc.core.config.ConfigFileWriter(config_file_path: Union[pathlib.Path, str] =
                                         PosixPath('config.yaml'))

```

Bases: object

Read Config Files (in different formats) to Python Dictionary

**write\_to\_yaml()** → None

```

class dvc.core.config.ConfigReader(config_file_path: Union[pathlib.Path, str] = PosixPath('config.yaml'))

```

Bases: object

Read Config (in different formats) to Python Dictionary

Precedence in descending order 1. Config File 2. Environment Variable

```

class dvc.core.config.DatabaseConnectionFactory(config_reader: dvc.core.config.ConfigReader)

```

Bases: object

Return connections for various databases

```

MAPPING = {SupportedDatabaseFlavour.Postgres: 'self.pgconn'}

```

**property conn:** `psycopg2.extensions.connection`

Return the expected connection object for different database flavours :return:

**property pgconn:** `psycopg2.extensions.connection`

Return Postgres Database Connection

**Returns**

**validate\_requested\_database\_flavour()** → *dvc.core.database.SupportedDatabaseFlavour*

Validate if requested database flavour is supported

**Returns**

**class** `dvc.core.config.DatabaseRevisionFilesManager`(*config\_file\_reader:*  
*dvc.core.config.ConfigReader*)

Bases: object

Manager all Database Revision Files

**class** `Pointer`

Bases: object

Head: All the way to the latest

**BASE** = 'base'

**HEAD** = 'head'

**create\_database\_revision\_files\_folder()** → None

Safely create the database revision files folder.

**get\_target\_database\_revision\_files\_by\_pointer**(*current\_database\_version:*  
*dvc.core.struct.DatabaseVersion,*  
*candidate\_database\_revision\_files:*  
*List[dvc.core.struct.DatabaseRevisionFile],*  
*pointer:*  
*dvc.core.config.DatabaseRevisionFilesManager.Pointer*)  
→ *List[dvc.core.struct.DatabaseRevisionFile]*

Given current database version and pointer, filter for target database revision files in the folder

**Parameters**

- **current\_database\_version** –
- **candidate\_database\_revision\_files** –

**Returns**

**get\_target\_database\_revision\_files\_by\_steps**(*current\_database\_version:*  
*dvc.core.struct.DatabaseVersion,* *steps: int,*  
*candidate\_database\_revision\_files:*  
*List[dvc.core.struct.DatabaseRevisionFile]*) →  
*List[dvc.core.struct.DatabaseRevisionFile]*

Given current database version and number of steps, filter for target database revision files in the folder.

**Returns**

**dvc.core.exception module****exception** `dvc.core.exception.DatabaseConnectionFailureException`Bases: `Exception`

Exception raised when connection to the database fails

**exception** `dvc.core.exception.EnvironmentVariableNotSetException(missing_env_var: str)`Bases: `Exception`

Exception raised when required environment variables are not found

**exception** `dvc.core.exception.InvalidDatabaseRevisionFilesException(status:``dvc.core.exception.InvalidDatabaseRevisionFile  
config_file_path:  
Optional[pathlib.Path],  
database_revision_file_paths:  
List[pathlib.Path])`Bases: `Exception`

Exception Raised when something is wrong with the DatabaseRevisionFiles

**class** `Status(value)`Bases: `enum.Enum`

List of all reasons

`FEWER_REVISION_SQL_FILES_FOUND_THAN_REQUIRED_STEPS_SPECIFIED = 103``MORE_REVISION_SQL_FILES_FOUND_THAN_REQUIRED_STEPS_SPECIFIED = 102``NONCONSECUTIVE_REVISION_SQL_FILES_FOR_HEAD_OR_BASE_POINTER = 104``NON_CONFORMANT_REVISION_FILE_NAME_EXISTS = 101`**exception** `dvc.core.exception.InvalidDatabaseVersionException(database_version: str)`Bases: `Exception`

Exception raised when format of Database Version is wrong

**exception** `dvc.core.exception.OperationNotAccountedForException(operation_type=<enum  
'Operation'>)`Bases: `Exception`

Exception raised when operation is requested but is not yet developed

**exception** `dvc.core.exception.RequestedDatabaseFlavourNotSupportedException(requested_database_flavour:  
str)`Bases: `Exception`

Exception raised when requested database flavour is not supported

### dvc.core.file module

`dvc.core.file.validate_file_exist(file_path: pathlib.Path) → None`  
Throw `FileNotFoundError` if a given file does not exist

### dvc.core.hash module

**class** `dvc.core.hash.FileHasher`  
Bases: `object`  
Hash content of any given file  
`md5(file_path: pathlib.Path) → str`  
Extract content from a file and hash its output  
**Parameters** `file_path` – Pathlib Path  
**Returns** string

### dvc.core.logger module

**class** `dvc.core.logger.SetRootLoggingLevel(func)`  
Bases: `object`  
Used as a decorator to set the root logging level  
`set_logging_level(logging_level: int)`

### dvc.core.regex module

`dvc.core.regex.get_matched_files_in_folder_by_regex(folder_path: pathlib.Path, file_name_regex: str)`  
→ `List[pathlib.Path]`  
Loop recursively for all files in a given folder. Return those files whose name satisfy the regex.  
**Parameters**

- `folder_path` – Path pointing to the folder with files
- `file_name_regex` – regex used to filter for files with the desired file name

**Returns**

### dvc.core.struct module

**class** `dvc.core.struct.DatabaseRevisionFile(file_path: pathlib.Path)`  
Bases: `object`  
Raise error when File Path does not conform to standard  
`STANDARD_RV_FILE_FORMAT_REGEX = '^RV[0-9]+__.*\\. (upgrade|downgrade)\\.sql$'`  
**property description: str**  
Get the file description  
**Returns**

**property ending: str**

Get the file ending

**Returns**

**classmethod get\_dummy\_revision\_file**(*revision: str, operation\_type: dvc.core.struct.Operation*) → *dvc.core.struct.DatabaseRevisionFile*

Return a dummy revision file

**Parameters**

- **revision** –
- **operation\_type** –

**Returns**

**property operation\_type: dvc.core.struct.Operation**

Get the operation type

**Returns**

**property revision\_number: int**

Get the revision number

**Returns**

**class dvc.core.struct.DatabaseVersion**(*version: str, created\_at: Optional[datetime.datetime] = None*)  
Bases: object

**STANDARD\_DATABASE\_VERSION\_FORMAT\_REGEX** = '^V[0-9]+\$'

**property created\_at**

**property next\_downgrade\_database\_revision\_file:**

*dvc.core.struct.DatabaseRevisionFile*

Get the database revision file for downgrade :return:

**property next\_upgrade\_database\_revision\_file: dvc.core.struct.DatabaseRevisionFile**

Get the database revision file for upgrade :return:

**property version**

**property version\_number: int**

**class dvc.core.struct.Operation**(*value*)

Bases: enum.Enum

Database Operations Allowed

**Downgrade** = 'downgrade'

**Upgrade** = 'upgrade'

Module contents

Submodules

dvc.version module

Module contents

## 7.2 Tests Package

### 7.2.1 tests package

Subpackages

tests.assets package

Module contents

tests.test\_dvc package

Subpackages

tests.test\_dvc.test\_app package

Subpackages

tests.test\_dvc.test\_app.test\_cli package

Subpackages

tests.test\_dvc.test\_app.test\_cli.test\_commands package

Subpackages

tests.test\_dvc.test\_app.test\_cli.test\_commands.test\_database package

Submodules

tests.test\_dvc.test\_app.test\_cli.test\_commands.test\_database.test\_backend module

Module contents

Submodules

tests.test\_dvc.test\_app.test\_cli.test\_commands.test\_config module



**tests.test\_dvc.test\_app.test\_cli.test\_commands.test\_main module**

`tests.test_dvc.test_app.test_cli.test_commands.test_main.test__version__only_contain_semver()`  
 Test *dvc version* command output version in SemVer format

**tests.test\_dvc.test\_app.test\_cli.test\_commands.test\_sql module****Module contents****Module contents****Module contents****tests.test\_dvc.test\_core package****Submodules****tests.test\_dvc.test\_core.test\_config module**

**class** `tests.test_dvc.test_core.test_config.TestConfigFileWriter`

Bases: `object`

**pytestmark** = `[Mark(name='unit', args=(), kwargs={})]`

**test\_\_write\_dummy\_user\_configuration**(*dummy\_user\_configuration\_with\_supported\_db\_flavour*,  
*dummy\_absent\_config\_file\_path*)

GIVEN a non-existing config file path WHEN `ConfigFileReader.user_config` is called THEN check dummy user configuration is returned

**class** `tests.test_dvc.test_core.test_config.TestConfigReader`

Bases: `object`

**pytestmark** = `[Mark(name='unit', args=(), kwargs={})]`

**test\_\_when\_both\_config\_file\_and\_env\_var\_and\_absent\_\_raise\_environment\_variables\_not\_set\_exception**(*dummy\_user\_configuration\_with\_supported\_db\_flavour*,  
*dummy\_absent\_config\_file\_path*)

GIVEN a dummy config file with dummy user configuration, WHEN `ConfigFileReader.user_config` is called THEN check dummy user configuration is returned

**test\_\_when\_config\_file\_is\_absent\_but\_env\_var\_present\_\_return\_expected\_user\_config\_from\_env\_var**(*dummy\_user\_configuration\_with\_supported\_db\_flavour*,  
*dummy\_absent\_config\_file\_path*,  
*dummy\_env\_var\_key\_value*)

GIVEN a dummy config file with dummy user configuration, WHEN `ConfigFileReader.user_config` is called THEN check dummy user configuration is returned

**test\_\_when\_config\_file\_is\_persent\_\_return\_expected\_user\_config\_from\_config\_file**(*dummy\_user\_configuration\_with\_supported\_db\_flavour*,  
*dummy\_existing\_config\_file\_path*)

GIVEN a dummy config file with dummy user configuration, WHEN `ConfigFileReader.user_config` is called THEN check dummy user configuration is returned

**class** `tests.test_dvc.test_core.test_config.TestDatabaseConnectionFactory`

Bases: `object`

**pytestmark** = `[Mark(name='unit', args=(), kwargs={})]`

```
test__pass_user_credentials_to_connect_as_kwargs(dummy_config_file_reader_with_supported_db_flavour,
                                                  dummy_pgconn)
```

(Currently test postgres specifically) GIVEN patched psycopg2.connect WHEN DatabaseConnectionFactory.conn is called THEN check psycopg2.connect is called once and with expected args

```
test__raise_requested_database_not_supported_exception(dummy_config_file_reader_with_unsupported_db_flavour,
```

GIVEN a fake database flavour WHEN DatabaseConnectionFactory.validate\_requested\_database\_flavour is called THEN assert RequestedDatabaseFlavourNotSupportedException is raised

```
class tests.test_dvc.test_core.test_config.TestDatabaseRevisionFilesManager
```

Bases: object

```
pytestmark = [Mark(name='unit', args=(), kwargs={})]
```

```
test__get_target_database_revision_files_by_pointer(dummy_config_file_reader_with_supported_db_flavour,
                                                    current_database_version,
                                                    candidate_database_revision_files, steps,
                                                    expected_database_revision_files,
                                                    expected_exception)
```

### tests.test\_dvc.test\_core.test\_logger module

```
class tests.test_dvc.test_core.test_logger.TestSetRootLoggingLevel
```

Bases: object

Test Set RootLoggingLevel as a decorator

```
test__when_config_file_and_env_var_are_absent__set_to_default_logging_level(any_func,
                                                                              dummy_user_configuration_v
                                                                              dummy_absent_config_file_p
```

GIVEN config file is absent and no env var is set WHEN SetRootLoggingLevel is called THEN use default logging level

#### Parameters

- any\_func –
- dummy\_user\_configuration\_with\_supported\_db\_flavour –
- dummy\_absent\_config\_file\_path –

#### Returns

```
test__when_config_file_is_absent_but_env_var_is_present__set_to_user_defined_logging_level(any_func,
                                                                                          dummy_u
                                                                                          dummy_a
```

GIVEN config file is absent but env vars are set WHEN SetRootLoggingLevel is called THEN use the env vars' logging levels

#### Parameters

- any\_func –
- dummy\_user\_configuration\_with\_supported\_db\_flavour –
- dummy\_absent\_config\_file\_path\_with\_env\_var –

#### Returns

**test\_\_when\_config\_file\_is\_present\_but\_env\_var\_is\_absent\_\_set\_to\_config\_file\_logging\_level** (*any\_func*, *dummy\_user\_configuration\_with\_supported\_db\_flavour*, *dummy\_existing\_config\_file\_path*)

GIVEN config file is present and no env vars are set WHEN SetRootLoggingLevel is called THEN use the config file's logging level

#### Parameters

- *any\_func* –
- *dummy\_user\_configuration\_with\_supported\_db\_flavour* –
- *dummy\_existing\_config\_file\_path* –

#### Returns

`tests.test_dvc.test_core.test_logger.any_func()` → Callable  
Return a function which accepts any args and kwargs, but does nothing :return:

### tests.test\_dvc.test\_core.test\_regex module

**class** `tests.test_dvc.test_core.test_regex.TestGetMatchedFilesInFolderByRegex`

Bases: `object`

`pytestmark = [Mark(name='unit', args=(), kwargs={})]`

**test\_\_get\_matched\_files\_in\_folder\_by\_regex\_\_assert\_number\_sql\_files** (*dummy\_regex\_files\_folder\_with\_correct\_file\_name\_regex*, *expected\_num\_matched\_files\_paths*)

GIVEN a dummy folder with dummy files WHEN `get_matched_files_in_folder_by_regex` is called with a certain regex THEN the returned paths should match the regex

### tests.test\_dvc.test\_core.test\_struct module

**class** `tests.test_dvc.test_core.test_struct.TestDatabaseRevisionFile`

Bases: `object`

**test\_database\_revision\_files\_comparison** (*file\_1*, *file\_2*, *predicate*, *expected*)

**test\_valid\_database\_revision\_files** (*sql\_file\_name: str*, *expectation*)

**class** `tests.test_dvc.test_core.test_struct.TestDatabaseVersion`

Bases: `object`

**test\_valid\_dummy\_database\_revision\_files\_with\_order** (*target\_database\_version: dvc.core.struct.DatabaseVersion*, *current\_database\_version: dvc.core.struct.DatabaseVersion*, *expected\_dummy\_database\_revision\_files: List[dvc.core.struct.DatabaseRevisionFile]*)

Module contents

Module contents

Submodules

tests.conftest module

Module contents

## 7.3 Test Report

- See latest test report: [here](#)

## CHANGE LOG

### 8.1 0.6.0

- Added flexibility to place schema-tracking tables in a user-defined schema.

### 8.2 0.5.1

- Removed bugs which throw errors when config.yaml is absent without fallback on environment variables.
- Fixed wrong regex for testing SemVer pattern.

### 8.3 0.5.0

- Added `--dry-run` to both *dvc db upgrade* and *dvc db downgrade*. When set to True, the CLI will stop before the execution of SQL files
- **For DatabaseRevisionFilesManager class:**
  - Added tests for i. getting files by pointer and ii. getting files by steps methods
  - Made both methods use the same exception handling `raise_for_status()` method
- Added option to change logging level in config file and env variables
- Added demo files and step-by-step guide under in the [feature pages](#)
- Added *dvc cfg show* to show some configurations

### 8.4 0.4.0

- Added dynamic generation of src package and tests package documentation in docs with sphinx-apidoc.
- Added `--head` to *dvc db upgrade* and `--base` *dvc db downgrade* respectively

## 8.5 0.3.3

- Added CI testing for binaries generated for 3 Oses. For Windows, Ubuntu Linux and Mac, run the below in the CI pipeline:
  - Build binary
  - Run postgres server. Run all DVC commands against it.
  - Push to Github release

## 8.6 0.3.2

- Included `./setup.cfg` to Dockerfile. Fixed missing `.sql` files in Docker Image to Dockerhub

## 8.7 0.3.1

- Moved `package_data` to `setup.cfg`. Fixed missing `.sql` files in PyPI.

## 8.8 0.3.0

- Added `–steps` and `–confirm` flags to `dvc db upgrade` and `dvc db downgrade`
- **Added dunder methods for the below classes:**
  - `__le__`, `__gr__`, `__eq__` for `DatabaseRevisionFile`
  - `__add__`, `__sub__`, `__eq__` for `DatabaseVersion`
- **Codified the below relationship with dunder methods:**
  - `DatabaseVersion - DatabaseVersion = [DatabaseRevisionFiles]`
  - `DatabaseVersion + DatabaseRevisionFile = DatabaseVersion`
- Removed `dvc sql generate`, as that is Files System related.
- Added diagram to illustrate `DatabaseVersion` and `DatabaseRevisionFile`

## 8.9 0.2.1

- **Refactored Github workflows. Separated the below components from Github Workflows**
  - Running pytest
  - Building and pushing python library to PyPI
  - Building and Pushing artifacts to Readthedocs
  - Building and pushing to Dockerhub
  - Building and pushing Linux, Mac and Windows binaries to Github Releases

## 8.10 0.2.0

- Included help text and documentation URL in the CLI.
- Followed SemVer more closely. Bumped minor version with added feature and bump patch for bug fixes. Switched to using tag (not branch) for releases.

## 8.11 0.1.16

- Created binaries for windows, mac and linux with pyinstaller. added sql files to the binaries.
- Removed confirmation for both upgrade and downgrade command (i.e. *dvc db upgrade* and *dvc db downgrade*)

## 8.12 0.1.15

- Update Dockerfile. Changed instruction CMD to ENTRYPOINT for dvc command.
- Added pages to documentation using sphinx
- Created graphs using graphviz and dots
- **Added Github Action workflows to automate the below:**
  - generating pytest report artifacts
  - pushing both artifacts and .rst files to Readthedocs for building documentation

## 8.13 0.1.14

- Created ConfigReader, ConfigFileWriter and other objects to hold states.
- Added the option to pass configuration as environment variables.
- Added unit tests and integrations tests (for postgres)
- Created Dockerfile to containerise the tool
- Created docker-compose.yml file for demonstration purposes. Created demo\_assets to be attached as volume to docker-compose containers.
- **Added Github Action workflows to automate the below:**
  - Pushing Docker image (with different tags) and readme to Dockerhub.
  - Pushing the tool to PYPI







## 9.1 About Me

- Language enthusiast
- Fan of automation via technology

## 9.2 Contact

Contact me via:

- [linkedin](#)



**SUMMARY**

Compute (Application) and Storage (Database) are decoupled.

When you make changes to your application code, you should also make changes to your database. In other words, you probably want to version control both your application code and your database. Without version controlling both, any changes in either side can cause incompatibility issues and break the entire service as a whole.

Use DVC now to version control your database!



## DESCRIPTION

Database Version Control (DVC) is a CLI utility which version controls your database in the following ways:

- Generate metadata table(s) in your database;
- For each SQL script applied, update the metadata table(s);
- Exposes the metadata via CLI commands.



## **BENEFITS**

- Rich metadata is available in the database. The database can be directly queried with SQL for both historical and current database versions.
- Only plain SQL files are accepted. No extra abstraction layer as is generally available in ORM.





## MORE INFORMATION

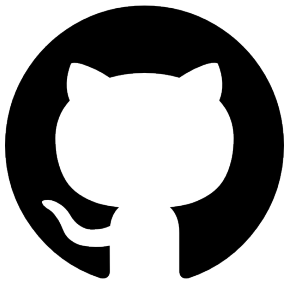


Fig. 1: Code on GitHub



Fig. 2: Docker Image on Dockerhub

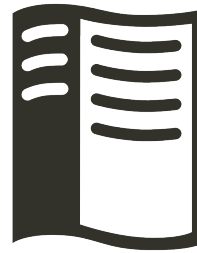


Fig. 3: Documentation on Readthedocs (latest)



Fig. 4: Demo on Youtube



**SUPPORTED DATABASES**

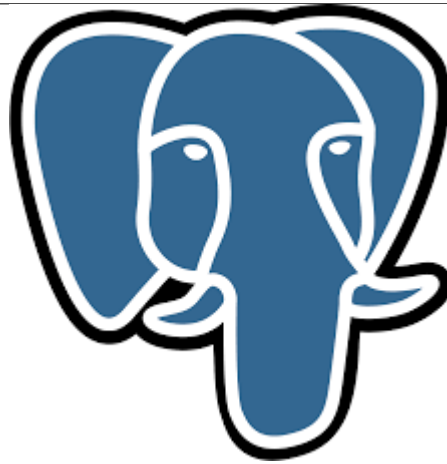


Fig. 1: PostgreSQL



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