Alembic Database migrations

START HERE

`alembic init <dir>`
Create migration environment

`alembic current`
Where is the database?

`alembic revision --autogenerate -m "<msg>"`
Diff models, write script

`alembic history`
List all revisions

`alembic upgrade head`
Apply all migrations

`alembic heads`
Show newest revisions

`alembic downgrade -1`
Undo last migration

`alembic stamp head`
Mark as up to date

Models target_metadata → `revision --autogenerate` → **Script** versions/*.py → `upgrade` → **Database** alembic_version table

CONCEPTS

Always read an autogenerated script before running it: it misses some changes and can be wrong.

The database stores only the current revision id, in the alembic_version table.

Revisions form a chain (down_revision); two scripts with the same parent create branches.

SETUP

`alembic init <dir>`
Create scripts dir and alembic.ini

`alembic init -t async <dir>`
Init with the async template

`alembic init -t pyproject <dir>`
Init with config in pyproject.toml

`alembic list_templates`
List init templates

`alembic -c <file> <cmd>`
Use another config file

`alembic -n <name> <cmd>`
Use another ini section

`alembic -x <key>=<value> <cmd>`
Pass an argument to env.py

`alembic --raiseerr <cmd>`
Show full stack trace on error

Set sqlalchemy.url in alembic.ini or override it in env.py, and set target_metadata there to your models' MetaData.

CREATE REVISIONS

`alembic revision -m "<msg>"`
New empty migration script

`alembic revision --autogenerate -m "<msg>"`
Script from model vs. database diff

`alembic revision --rev-id <id> -m "<msg>"`
Choose the revision id yourself

`alembic revision --head <rev> -m "<msg>"`
Base the new script on a given head

`alembic revision --branch-label <name> -m "<msg>"`
Start a labelled branch

CREATE REVISIONS (cont.)

`alembic revision --depends-on <rev> -m "<msg>"`
Require another revision first

`alembic check`
Fail if models differ from scripts
Exits non-zero when autogenerate would produce changes: handy in CI.

`alembic edit <rev>`
Open a script in $EDITOR

RUN MIGRATIONS

`alembic upgrade head`
Migrate to the newest revision

`alembic upgrade +1`
Apply the next migration

`alembic upgrade <rev>`
Migrate up to a revision
A unique prefix of the id is enough.

`alembic upgrade <rev>+<n>`
Move n steps up from a revision

`alembic downgrade -1`
Undo the last migration

`alembic downgrade <rev>`
Roll back to a revision

`alembic downgrade base`
Roll back everything

`alembic upgrade <from>:<to> --sql`
Print SQL instead of running it
Offline mode needs the start revision as <from>:<to>; env.py must support it.

`alembic upgrade head --tag <tag>`
Pass a tag to env.py

INSPECT

`alembic current`
Show the database's revision

`alembic current -v`
Current revision with details

`alembic current --check-heads`
Fail if database is not at head

`alembic history`
List revisions, newest first

`alembic history -v`
History with full details

`alembic history -i`
Mark the current revision

`alembic history -r <a>:<b>`
Show a revision range
A negative start needs the no-space form: -r-3:current.

`alembic heads`
Show newest revisions

INSPECT (cont.)

`alembic branches`
Show branch points

`alembic show <rev>`
Show one revision

BRANCHES AND REPAIR

`alembic merge heads -m "<msg>"`
Merge all heads into one
Needed when 'Multiple head revisions' blocks upgrade head.

`alembic merge <a> <b> -m "<msg>"`
Merge two specific revisions

`alembic upgrade <label>@head`
Upgrade one branch only

`alembic stamp head`
Mark database as up to date
Records the revision without running any migration.

`alembic stamp <rev>`
Mark database at a revision

`alembic stamp base`
Mark database as empty

`alembic stamp --purge <rev>`
Erase version table, then stamp

`alembic ensure_version`
Create the version table

INSIDE A SCRIPT

`op.create_table("<t>", sa.Column(...))`
Create a table

`op.drop_table("<t>")`
Drop a table

`op.add_column("<t>", sa.Column(...))`
Add a column

`op.drop_column("<t>", "<col>")`
Drop a column

`op.alter_column("<t>", "<col>", ...)`
Change type, null or name

`op.create_index("<ix>", "<t>", ["<col>"])`
Create an index

`op.create_foreign_key(...)`
Add a foreign key

`op.execute("<sql>")`
Run raw SQL

`op.batch_alter_table("<t>")`
Batch mode for SQLite changes
Used as a context manager; recreates the table where ALTER is unsupported.

INSIDE A SCRIPT (cont.)

`op.bulk_insert(<table>, [{...}])`
Insert rows in a migration

Write downgrade() too, or downgrade will fail; a bare pass leaves the change in place.

CONFIG

`file_template = %%(year)d_%%(month).2d_%%(day).2d_%%(rev)s_%%(slug)s`
Date-prefixed script names (alembic.ini)

`compare_type=True`
Detect column type changes (env.py)
Passed to context.configure(); not on by default in older versions.

`compare_server_default=True`
Detect default changes (env.py)

`render_as_batch=True`
Autogenerate batch ops (env.py)

`include_object=<fn>`
Skip objects in autogenerate (env.py)

`version_locations = <dir> <dir>`
Several script folders (alembic.ini)

Autogenerate does not detect table or column renames (it sees drop plus add); edit the script by hand to use rename ops.

RECIPES

First migration for existing models

```
alembic init migrations
# edit alembic.ini url and
env.py target_metadata
alembic revision --autogenerate
-m "initial"
alembic upgrade head
```

Adopt an existing database

```
alembic revision --autogenerate
-m "baseline"
# check the script, then skip
it on this database
alembic stamp head
```

Fix multiple heads

```
alembic heads
alembic merge heads -m "merge"
alembic upgrade head
```

Review SQL before production

```
alembic upgrade head --sql >
migrate.sql
alembic upgrade <from>:<to> --
sql
```