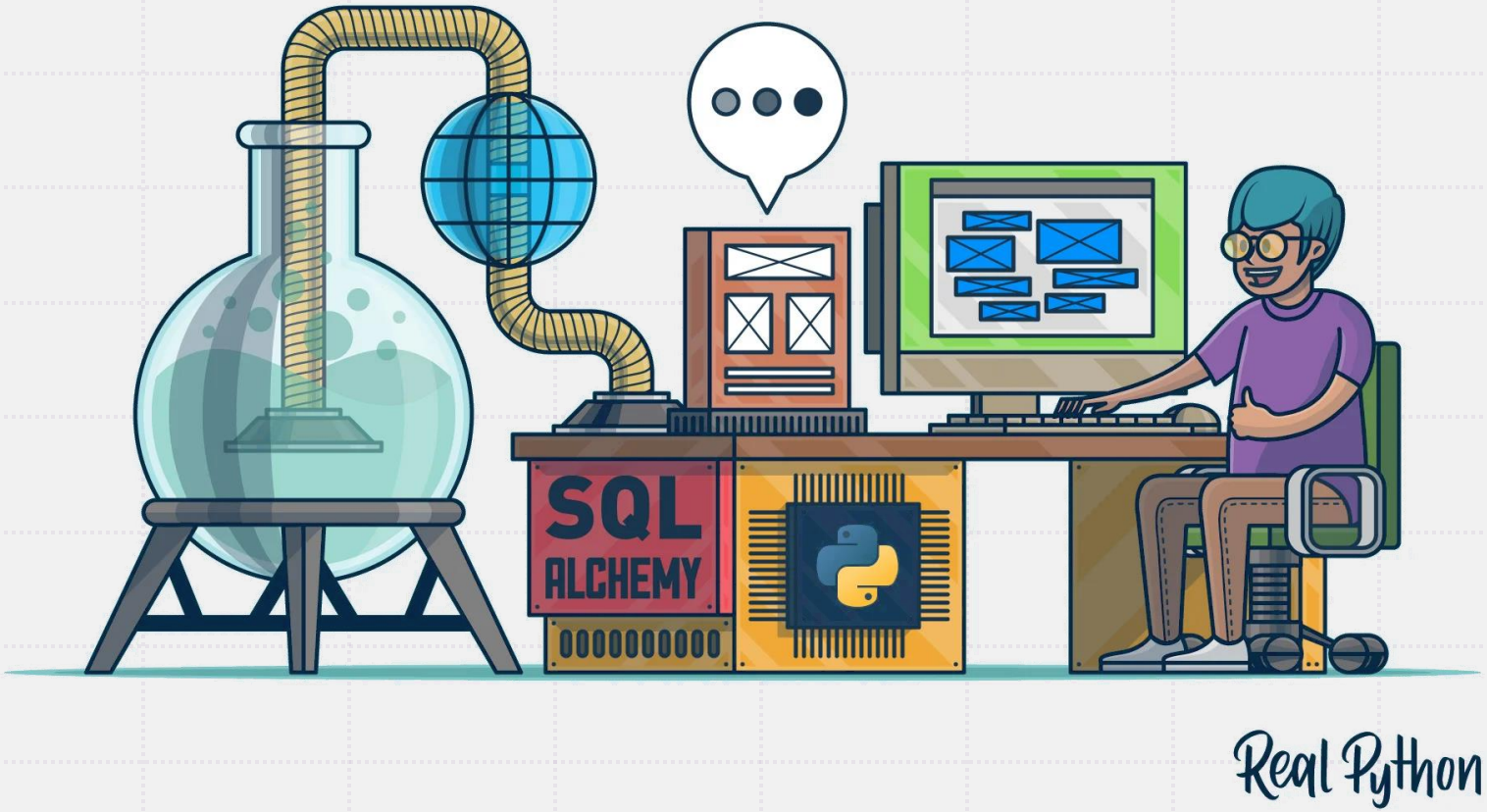
Programowanie baz danych

sqlalchemy 1



Plan na dzisiaj

- Przegląd narzędzi do pracy z bazami w Pythonie
- Wstęp do SQLAlchemy

Przegląd narzędzi bazodanowych dla Pythona

Connectors

MySQL Connector/Python Developer Guide

Abstract

This manual describes how to install and configure MySQL Connector/Python, a self-contained Python driver for communicating with MySQL servers, and how to use it to develop database applications.

The latest MySQL Connector/Python version is recommended for use with MySQL Server version 5.7 and higher.

For notes detailing the changes in each release of Connector/Python, see MySQL Connector/Python Release Notes.

For legal information, see the Legal Notices.

For help with using MySQL, please visit the MySQL Forums, where you can discuss your issues with other MySQL users.

Licensing information. This product may include third-party software, used under license. If you are using a Commercial release of MySQL Connector/Python, see the MySQL Connector/Python 8.3 Commercial License Information User Manual for licensing information, including licensing information relating to third-party software that may be included in this Commercial release. If you are using a Community release of MySQL Connector/Python, see the MySQL Connector/Python 8.3 Community License Information User Manual for licensing information, including licensing information relating to third-party software that may be included in this Community release.

Document generated on: 2024-03-11 (revision: 78035)

mysqlclient
latest
Search docs

MySQLdb User's Guide
MySQLdb Package
MySQLdb Frequently Asked Questions

Welcome to MySQLdb's documentation!

Contents:

Psycopg 2.9.9 documentation

Quick search

type to search

Psycopg – PostgreSQL database adapter for Python

Psycopg is the most popular PostgreSQL database adapter for the Python programming language. Its main features are the complete implementation of the Python DB API 2.0 specification and the thread safety (several threads can share the same connection). It was designed for heavily multi-threaded applications that create and destroy lots of cursors and make a large number of concurrent INSERTS or UPDATES.

Psycopg 2 is mostly implemented in C as a libpq wrapper, resulting in being both efficient and secure. It features client-side and server-side cursors, asynchronous communication and notifications, COPY support. Many Python types are supported out-of-the-box and adapted to matching PostgreSQL data types; adaptation can be extended and customized thanks to a flexible objects adaptation system.

Psycopg 2 is both Unicode and Python 3 friendly.

psycopg2

Contents

sqlite3 — DB-API 2.0 interface for SQLite databases

SQLite is a C library that provides a lightweight disk-based database that doesn't require a separate server process and allows accessing the database using a nonstandard variant of the SQL query language. Some applications can use SQLite for internal data storage. It's also possible to prototype an application using SQLite and then port the code to a larger database such as PostgreSQL or Oracle.

pysqlite was written by Gerhard Häring and provides a SQL interface compliant with the DB-API 2.0 specification described by PEP 249.

pysqlite

To use the module, you must first create a Connection object that represents the database. Here the data will be stored in the /tmp/example file:

```
conn = sqlite3.connect('/tmp/example')
```

You can also supply the special name :memory: to create a database in RAM.

Once you have a Connection, you can create a Cursor object and call its execute() method to perform SQL commands:

```
c = conn.cursor()

# Create table
c.execute('''create table stocks
(date text, trans text, symbol text,
 qty real, price real)''')

# Insert a row of data
c.execute("""insert into stocks
          values ('2006-01-05','BUY','RHAT',100,35.14)""")
```

ORMs

SQLAlchemy

THE DATABASE TOOLKIT FOR PYTHON

The Python SQL Toolkit and Object Relational Mapper

SQLAlchemy is the Python SQL toolkit and Object Relational Mapper that gives application developers the full power and flexibility of SQL.

It provides a full suite of well known enterprise-level persistence patterns, designed for efficient and high-performing database access, adapted into a simple and Pythonic domain language.

SQLALCHEMY'S PHILOSOPHY

SQL databases behave less like object collections the more size and performance start to matter; object collections behave less like tables and rows the more abstraction starts to matter. SQLAlchemy aims to accommodate both of these principles.

SQLAlchemy

SQLAlchemy considers the database to be a relational algebra engine, not just a collection of tables. Rows can be selected from not only tables but also joins and other select statements; any of these units can be composed into a larger structure. SQLAlchemy's expression language builds on this concept from its core.

SQLAlchemy is most famous for its object-relational mapper (ORM), an optional component that provides the **data mapper pattern**, where classes can be mapped to the database in open ended, multiple ways - allowing the object model and database schema to develop in a cleanly decoupled way from the beginning.

SQLAlchemy's overall approach to these problems is entirely different from that of most other SQL / ORM tools, rooted in a so-called **complimentarity-** oriented approach; instead of hiding away SQL and object relational details behind a wall of automation, all processes are **fully exposed** within a series of composable, transparent tools. The library takes on the job of automating redundant tasks while the developer remains in control of how the database is organized and how SQL is constructed.

The main goal of SQLAlchemy is to change the way you think about databases and SQL!

Read some key features of SQLAlchemy, as well as what people are saying about SQLAlchemy.

CURRENT RELEASES

1.4.21 - 2021-07-14 - announce
changes | migration notes | docs

1.3.24 - 2021-03-30 - announce
changes | migration notes | docs

SPONSOR SQLALCHEMY!

Donate Donate to SQLAlchemy through **PayPal**

Sponsor SQLAlchemy through the Tidelift Subscription

LATEST NEWS

SQLAlchemy 1.4.21 Released
Wed, 14 Jul 2021

SQLAlchemy 1.4.20 Released
Mon, 28 Jun 2021

SQLAlchemy 1.4.19 Released

Project Links

Donate to Pallets
Website
PyPI releases
Source Code
Issue Tracker

Contents

Flask-SQLAlchemy
- Requirements
- User Guide
- API Reference
- Additional Information

Quick search

Go

Flask SQLAlchemy

Flask-SQLAlchemy is an extension for Flask that adds support for SQLAlchemy to your application. It aims to simplify using SQLAlchemy with Flask by providing useful defaults and extra helpers that make it easier to accomplish common tasks.

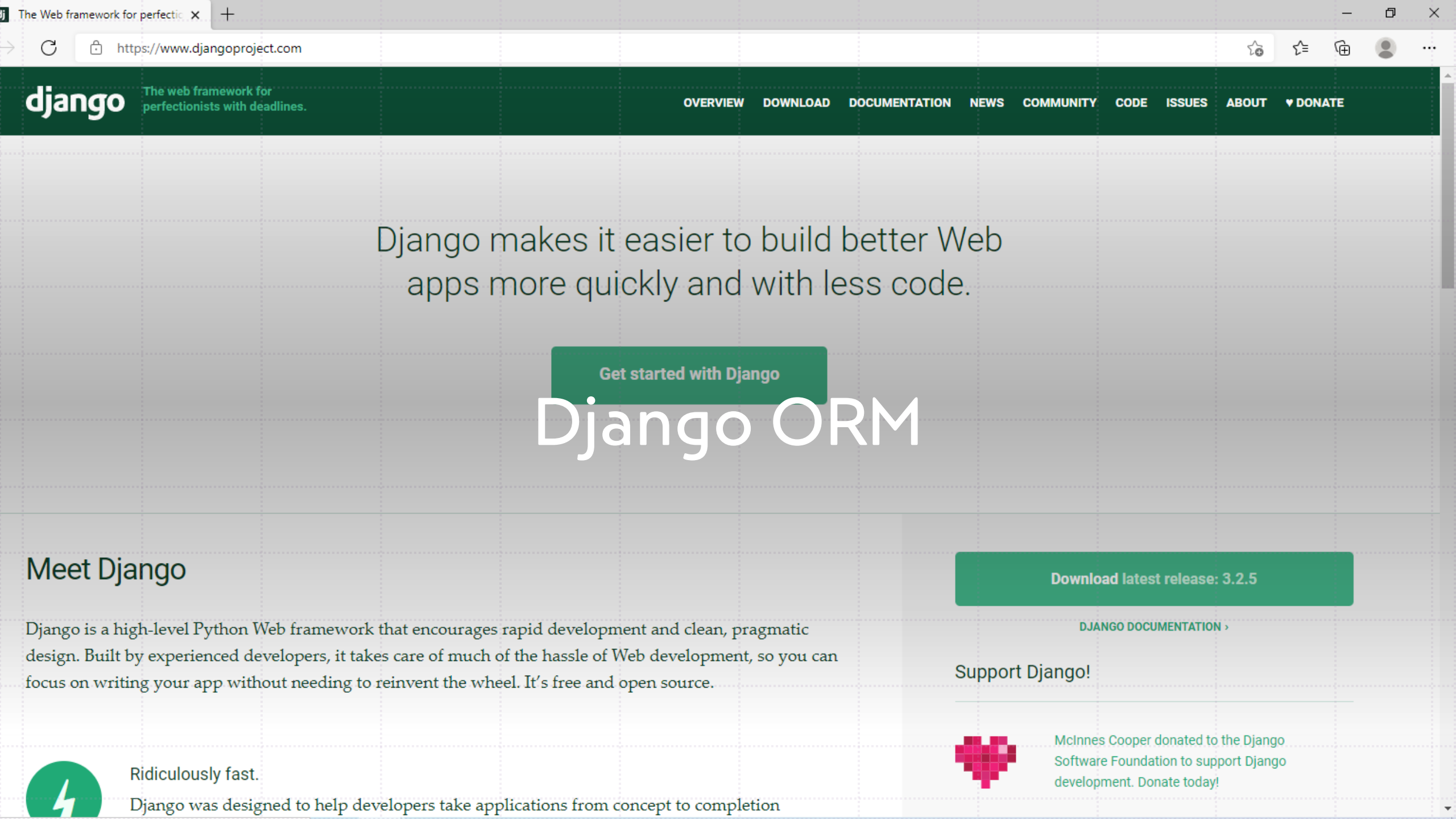
See the SQLAlchemy documentation to learn how to work with the ORM in depth. The following documentation is a brief overview of the most common tasks, as well as the features specific to Flask-SQLAlchemy.

Requirements

Our Version	Python	Flask	SQLAlchemy
2.1	2.7, 3.4+	0.12+	0.8+ or 1.0.10+ w/ Python 3.7
3.0+ (in dev)	2.7, 3.5+	1.0+	1.0+

User Guide

- Quickstart
  - A Minimal Application
  - Simple Relationships
  - Road to Enlightenment
- Introduction into Contexts
- Configuration
  - Configuration Keys
  - Connection URI Format
  - Using custom MetaData and naming conventions
  - Timeouts


The Web framework for perfectic
https://www.djangoproject.com
django
The web framework for perfectionists with deadlines.
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Django makes it easier to build better Web apps more quickly and with less code.
Get started with Django
Django ORM
Meet Django
Django is a high-level Python Web framework that encourages rapid development and clean, pragmatic design. Built by experienced developers, it takes care of much of the hassle of Web development, so you can focus on writing your app without needing to reinvent the wheel. It's free and open source.
Download latest release: 3.2.5
DJANGO DOCUMENTATION ›
Support Django!
McInnes Cooper donated to the Django Software Foundation to support Django development. Donate today!
Ridiculously fast.
Django was designed to help developers take applications from concept to completion

peewee

Peewee is a simple and small ORM. It has few (but expressive) concepts, making it easy to learn and intuitive to use.

- a small, expressive ORM
- python 2.7+ and 3.4+ (developed with 3.6)
- supports sqlite, mysql, postgresql and cockroachdb
- tons of extensions

Peewee's source code hosted on GitHub.

New to peewee? These may help:

PonyORM - Python ORM with be

https://ponyorm.org

Object-Relational Mapper

Docs Online editor Releases

Pony is a Python ORM with beautiful query syntax

Write your database queries using Python generators & lambdas

Try PonyORM now Support PonyORM

Free open-source software

Github Twitter Telegram Join the newsletter

Custom software development

Query builders

PyPika - Python Query Builder

build unknown coverage 98% Codacy docs passing pypi v0.48.9 license Apache-2.0

Abstract

What is *PyPika*?

PyPika is a Python API for building SQL queries. The motivation behind *PyPika* is to provide a simple interface for building SQL queries without limiting the flexibility of handwritten SQL. Designed with data analysis in mind, *PyPika* leverages the builder design pattern to construct queries to avoid messy string formatting and concatenation. It is also easily extended to take full advantage of specific features of SQL database vendors.

PyPika

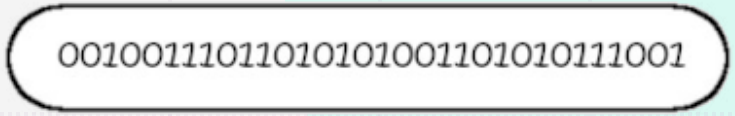
What are the design goals for *PyPika*?

PyPika is a fast, expressive and flexible way to replace handwritten SQL (or even ORM for the courageous souls amongst you). Validation of SQL correctness is not an explicit goal of *PyPika*. With such a large number of SQL database vendors providing a robust validation of input data is difficult. Instead you are encouraged to check inputs you provide to *PyPika* or appropriately handle errors raised from your SQL database - just as you would have if you were writing SQL yourself.

Contents

SQLAlchemy 2.0

Wstęp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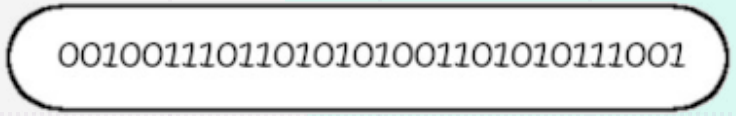
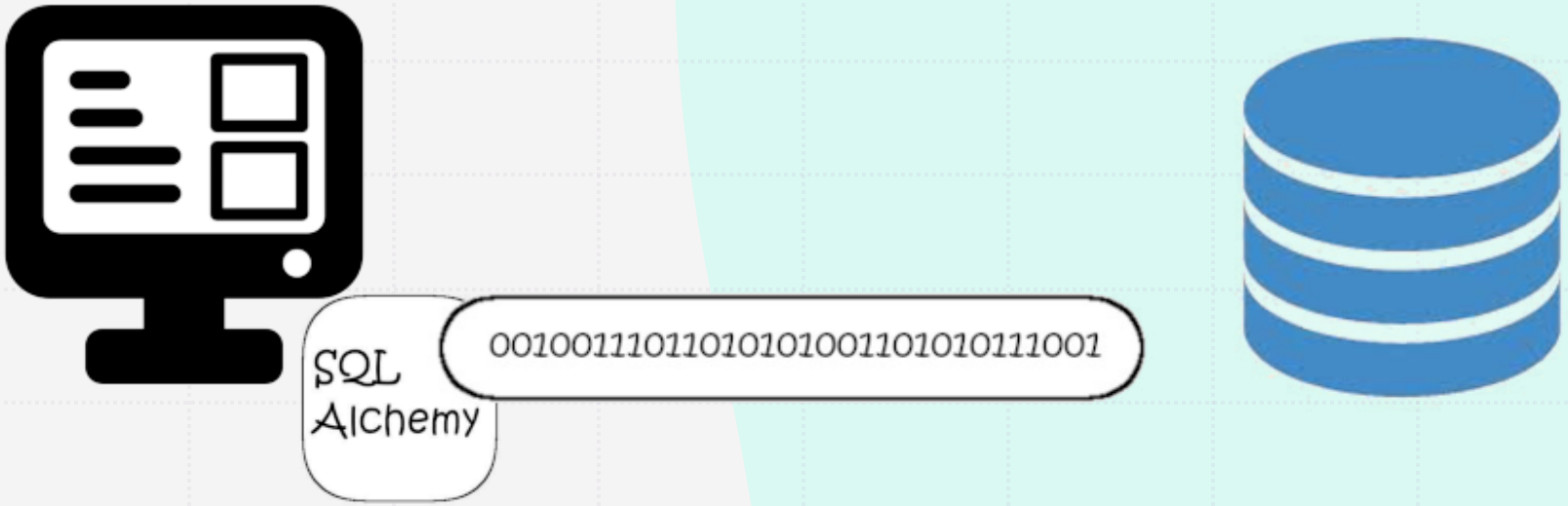
```
CREATE TABLE user
(
  user_id INT NOT NULL PRIMARY KEY,
);
```

ORACLE



```
CREATE TABLE user
(
  user_id numeric(10) not null,
  CONSTRAINT user_pk PRIMARY KEY (user_id)
);
```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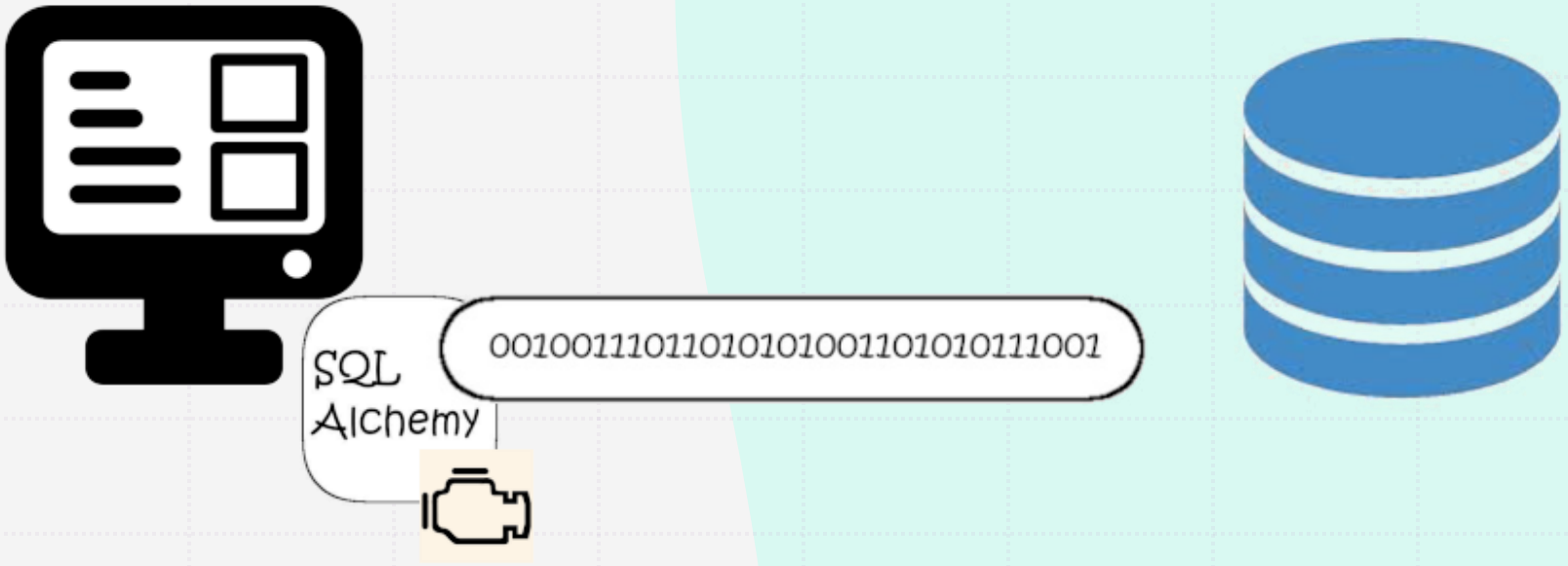
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Alchemy
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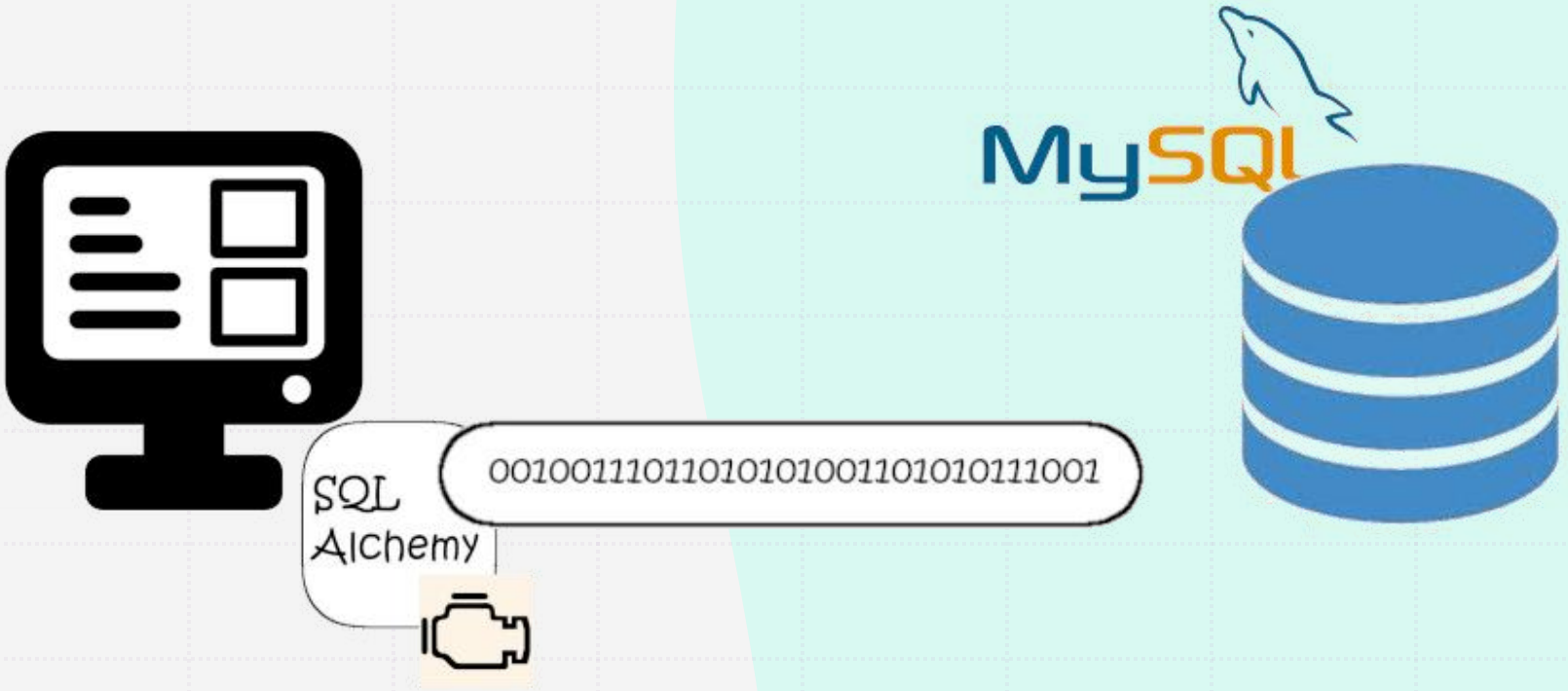
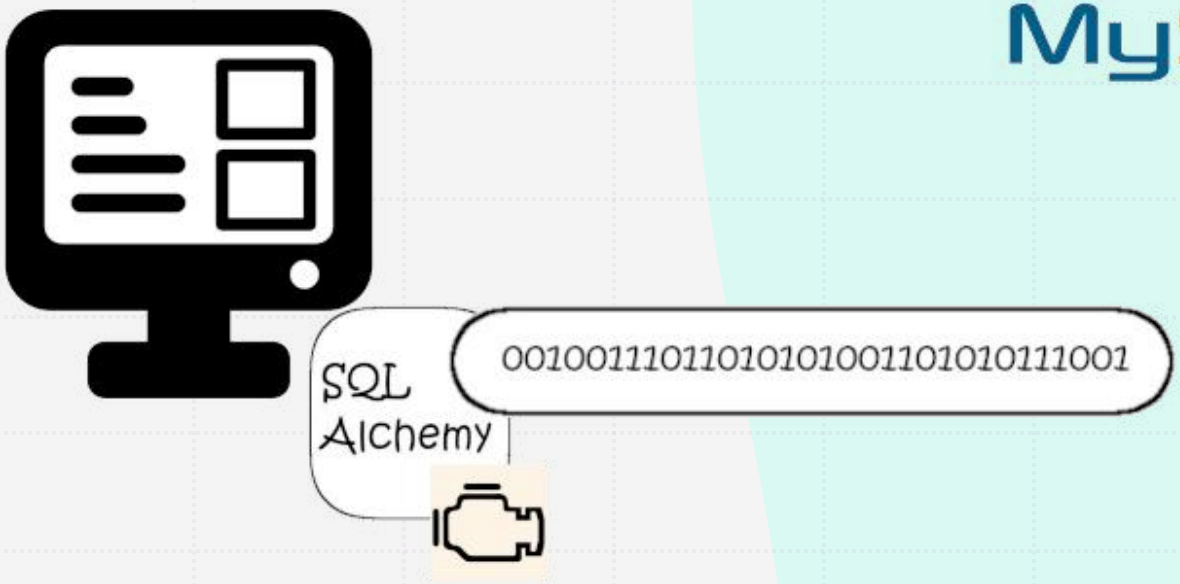



```
Table('user', metadata,
    Column('user_id', Integer, primary_key=True)
)
```

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)
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CREATE TABLE user
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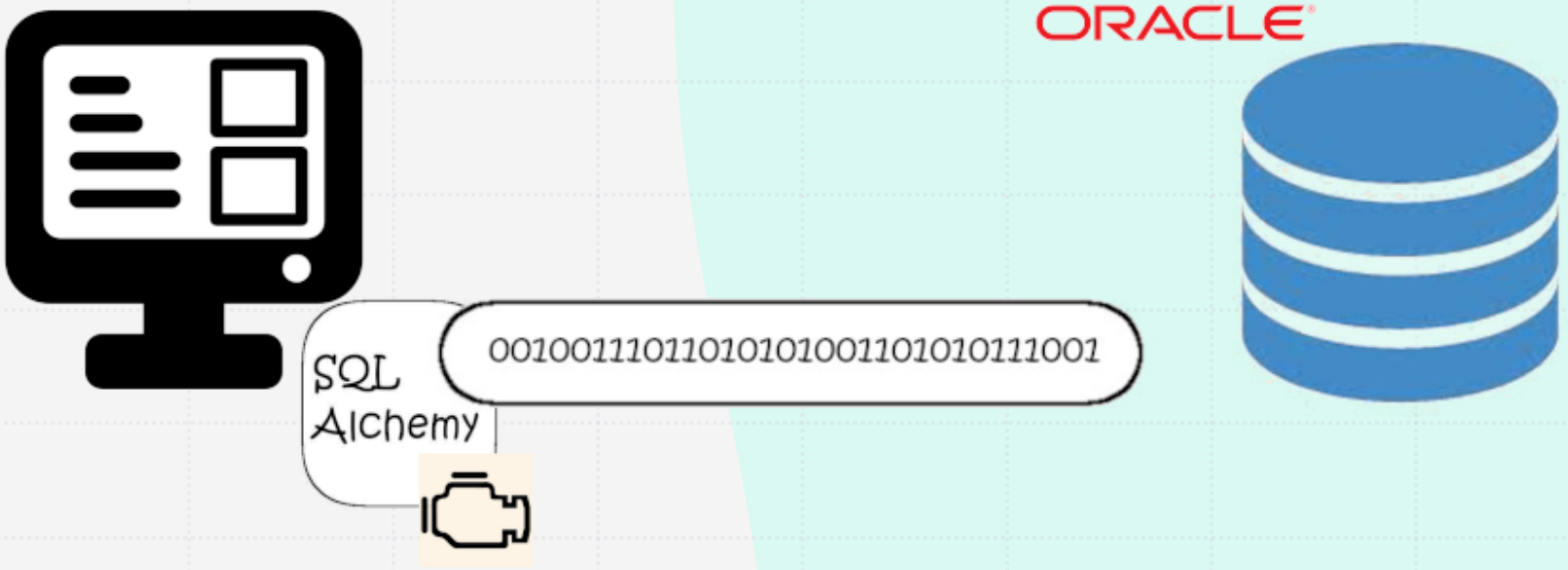
);
```




```
Table('user', metadata,
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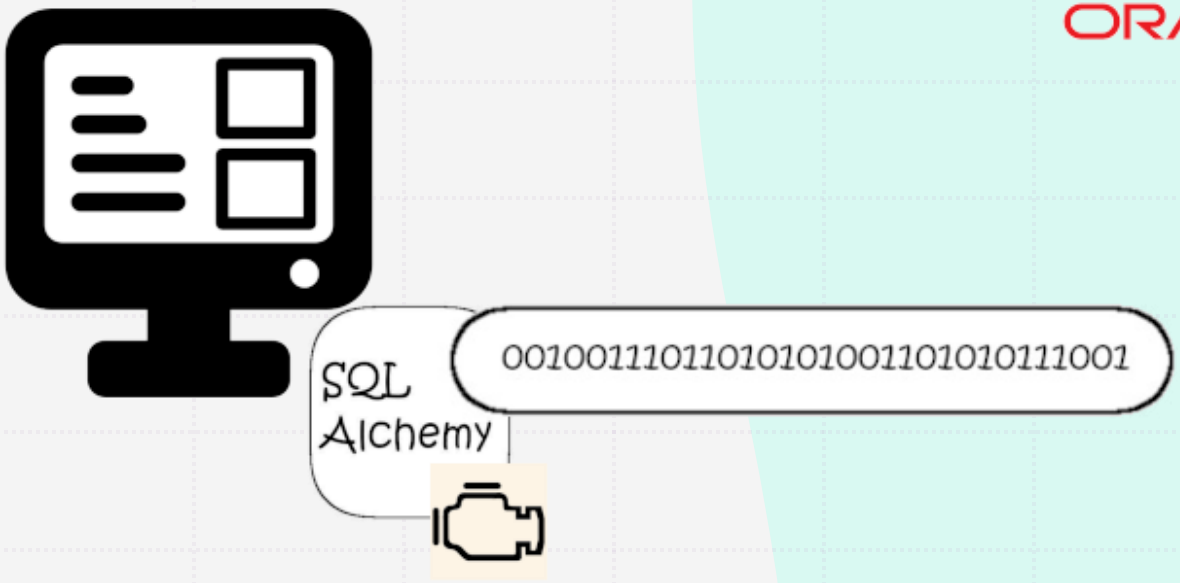
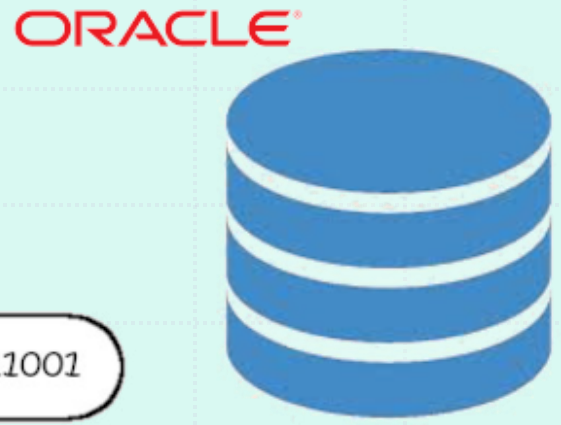
)
```



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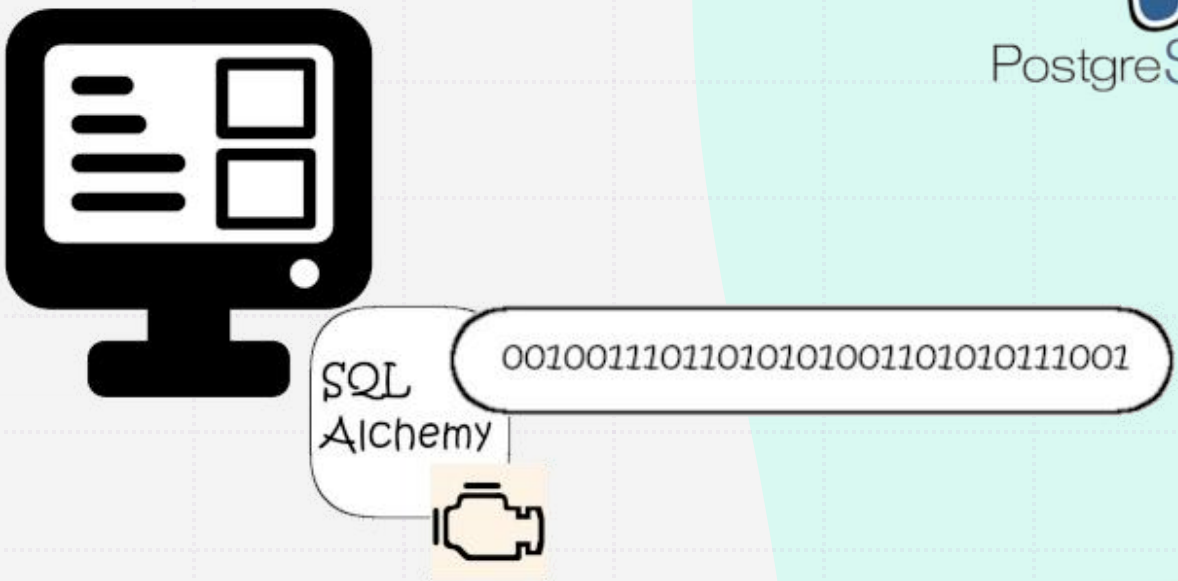
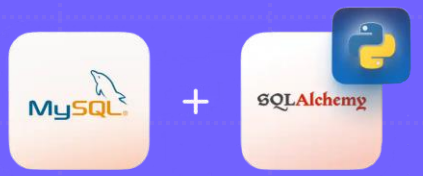



```
Table('user', metadata,
    Column('user_id', Integer, primary_key=True)
)
```

SQLAlchemy wstęp



SQLAlchemy

THE DATABASE TOOLKIT FOR PYTHON

The Python SQL Toolkit and Object Relational Mapper

SQLAlchemy is the Python SQL toolkit and Object Relational Mapper that gives application developers the full power and flexibility of SQL.

It provides a full suite of well known enterprise-level persistence patterns, designed for efficient and high-performing database access, adapted into a simple and Pythonic domain language.

Documentation

- **Current Documentation (version 2.0)** - learn SQLAlchemy here
  - Documentation Overview
  - Installation Guide
  - ORM Quickstart
  - Comprehensive Tutorial
  - **Reference Guides**
    - Object Relational Mapping (ORM)
    - Core (Connections, Schema Management, SQL)
    - Dialects (specific backends)
- **Documentation by Version**
  - Version 2.1 (development)
  - Version 2.0
  - Version 1.4
  - Version 1.3

CURRENT RELEASES

2.0.28 - 2024-03-04 - announce
changes | migration notes | docs

pypi v2.0.28 downloads 109M/month
python 3.7 | 3.8 | 3.9 | 3.10 | 3.11 | 3.12

1.4.52 - 2024-03-04 - announce
changes | migration notes | docs

2.1 - next major series
What's New in 2.1? | docs

SQLAlchemy documentation

SQLAlchemy

THE DATABASE TOOLKIT FOR PYTHON

SQLAlchemy 2.0 Documentation

Release: **2.0.28** CURRENT RELEASE | Release Date: March 4, 2024

Contents | Index | Download this Documentation

Search terms: search... Search

Getting Started

New to SQLAlchemy? Start here:

- **For Python Beginners:** Installation Guide - basic guidance on installing with pip and similar
- **For Python Veterans:** SQLAlchemy Overview - brief architectural overview

Tutorials

New users of SQLAlchemy, as well as veterans of older SQLAlchemy release series, should start with the SQLAlchemy Unified Tutorial, which covers everything an Alchemist needs to know when using the ORM or just Core.

- **For a quick glance:** ORM Quick Start - a glimpse at what working with the ORM looks like
- **For all users:** SQLAlchemy Unified Tutorial - In depth tutorial for Core and ORM

Migration Notes

Users coming from older versions of SQLAlchemy, especially those transitioning from the 1.x style of working, will want to review this documentation.

- Migrating to SQLAlchemy 2.0 - Complete background on migrating from 1.3 or 1.4 to 2.0
- What's New in SQLAlchemy 2.0? - New 2.0 features and behaviors beyond the 1.x migration
- Changelog catalog - Detailed changelogs for all SQLAlchemy Versions

Reference and How To

SQLAlchemy ORM - Detailed guides and API reference for using the ORM

- **Mapping Classes:** Mapping Python Classes | Relationship Configuration
- **Using the ORM:** Using the ORM Session | ORM Querying Guide | Using AsyncIO
- **Configuration Extensions:** Association Proxy | Hybrid Attributes | Mutable Scalars | Automap | All extensions
- **Extending the ORM:** ORM Events and Internals

SQLAlchemy Core - Detailed guides and API reference for working with Core

- **Engines, Connections, Pools:** Engine Configuration | Connections, Transactions, Results | AsyncIO Support | Connection Pooling
- **Schema Definition:** Overview | T… Introspection | R…

SQLAlchemy 2.0 documentation

https://pypi.org/project/SQLAlchemy/

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SQLAlchemy 2.0.28

```
pip install SQLAlchemy
```

Latest version

Released: Mar 4, 2024

Database Abstraction Library

Navigation

- Project description
- Release history
- Download files

Project links

- Homepage
- Documentation

Project description

pypi v2.0.28 | python 3.7 | 3.8 | 3.9 | 3.10 | 3.11 | 3.12 | downloads/month 103M

The Python SQL Toolkit and Object Relational Mapper

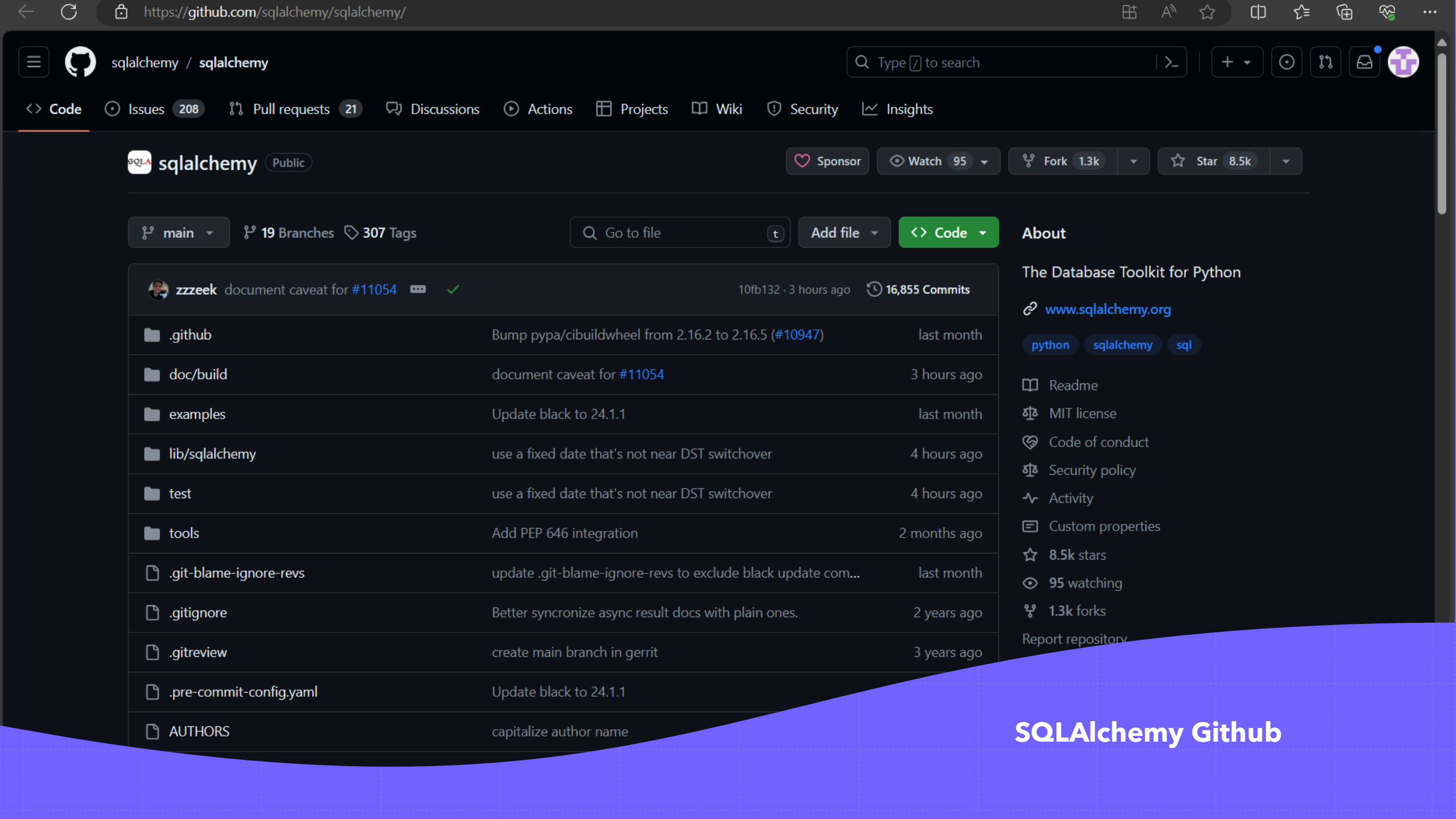
Introduction

SQLAlchemy is the Python SQL toolkit and Object Relational Mapper that gives application developers the full power and flexibility of SQL. SQLAlchemy provides a full suite of well known enterprise-level for efficient and high-performing database access, adapted into a

Major SQLAlchemy features include:

- An

SQLAlchemy PyPI



SQLAlchemy Github

Library - SQLAlchemy

sqlalchemy.org/library.html#tutorials

TUTORIALS

The most up-to-date and complete tutorials available for getting started with SQLAlchemy are: * the SQLAlchemy 1.4/2.0 Tutorial which is a full rewrite of the classic "1.x" SQLAlchemy tutorials; users starting with the latest SQLAlchemy releases should start here. * the Core and ORM tutorials are recommended for those using "1.x style" codebases. A few other online resources include:

- ***SQLAlchemy 2.0 - The One-Point-Four-Ening 2021*** **- Python Web Conf 2021**

  Author: Mike Bayer

  This is the newest version of the "getting started" tutorial that presents SQLAlchemy from the perspective of the new 2.0 series.

  - Video
  - Student Download

- ***Introduction to SQLAlchemy*** **- presented at many Pycon and other conferences**

SQLAlchemy tutorials

SQLAlchemy 2.0 Documentation
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Search terms: search...

Dialects

The **dialect** is the system SQLAlchemy uses to communicate with various types of DBAPI implementations and databases. The sections that follow contain reference documentation and notes specific to the usage of each backend, as well as notes for the various DBAPIs.

All dialects require that an appropriate DBAPI driver is installed.

Included Dialects

- PostgreSQL
- MySQL and MariaDB
- SQLite
- Oracle
- Microsoft SQL Server

Support Levels for Included Dialects

The following table summarizes the support level for each included dialect.

Database	Fully tested in CI	Normal support	Best effort
Microsoft SQL Server	2017	2012+	2005+
MySQL / MariaDB	5.6, 5.7, 8.0 / 10.8, 10.9	5.6+ / 10+	5.0.2+ / 5.0.2+
Oracle	18c	11+	9+
PostgreSQL	12, 13, 14, 15	9.6+	9+
SQLite	3.36.0	3.12+	3.7.16+

Supported database versions for included dialects

Dialekty

MySQL and MariaDB — SQLAlch

https://docs.sqlalchemy.org/en/20/dialects/mysql.html

SQLAlchemy

THE DATABASE TOOLKIT FOR PYTHON

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SQLAlchemy 2.0 Documentation

Release: **2.0.28** CURRENT RELEASE | Release Date: March 4, 2024

SQLAlchemy 2.0 Documentation

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Dialects

- PostgreSQL
- **MySQL and MariaDB**
  - Support for the MySQL / MariaDB database.
  - Supported Versions and Features
    - MariaDB Support
    - MariaDB-Only Mode
  - Connection Timeouts and Disconnects
  - CREATE TABLE arguments including Storage Engines
  - Case Sensitivity and Table Reflection
  - Transaction Isolation Level
  - AUTO_INCREMENT Behavior

MySQL and MariaDB

Support for the MySQL / MariaDB database.

The following table summarizes current support levels for database release versions.

Support type	Versions
Fully tested in CI	5.6, 5.7, 8.0 / 10.8, 10.9
Normal support	5.6+ / 10+
Best effort	5.0.2+ / 5.0.2+

Supported MySQL / MariaDB versions

DBAPI Support

The following dialect/DBAPI options are available. Please refer to individual DBAPI sections for connect information.

- mysqlclient (maintained fork of MySQL-Python)
- PyMySQL
- MariaDB Connector/Python
- MySQL Connector/Python
- asyncmy
- aiomysql
- CyMySQL
- PyODBC

Sterowniki mysql

SQLAlchemy 2.0 Documentation
CURRENT RELEASE
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Search terms: search...

MySQL-Connector

Support for the MySQL / MariaDB database via the MySQL Connector/Python driver.

DBAPI

Documentation and download information (if applicable) for MySQL Connector/Python is available at: https://pypi.org/project/mysql-connector-python/

Connecting

Connect String:

```
mysql+mysqlconnector://<user>:<password>@<host>[:<port>]/<dbname>
```

Note

The MySQL Connector/Python DBAPI has had many issues since its release, some of which may remain unresolved, and the mysqlconnector dialect is **not tested as part of SQLAlchemy's continuous integration**. The recommended MySQL dialects are mysqlclient and PyMySQL.

asyncmy

Support for the MySQL / MariaDB database via the asyncmy driver.

DBAPI

Documentation and download information (if applicable) for asyncmy is available at: https://github.com/long2ice/asyncmy

Connecting

Connect String:

```
mysql+asyncmy://user:password@host:port/dbname[?key=value&key=value...]
```

Using a special asyncio mediation layer, the asyncmy dialect is usable as the backend for the SQLAlchemy asyncio extension package.

This dialect should normally be used only with the `create_async_engine()` engine creation function:

```
from sqlalchemy.ext.asyncio import create_async_engine
engine = create_async_engine("mysql+asyncmy://user:pass@hostname/dbname?charset=utf8mb4")
```

Sterownik mysql-connector-python

Architektura

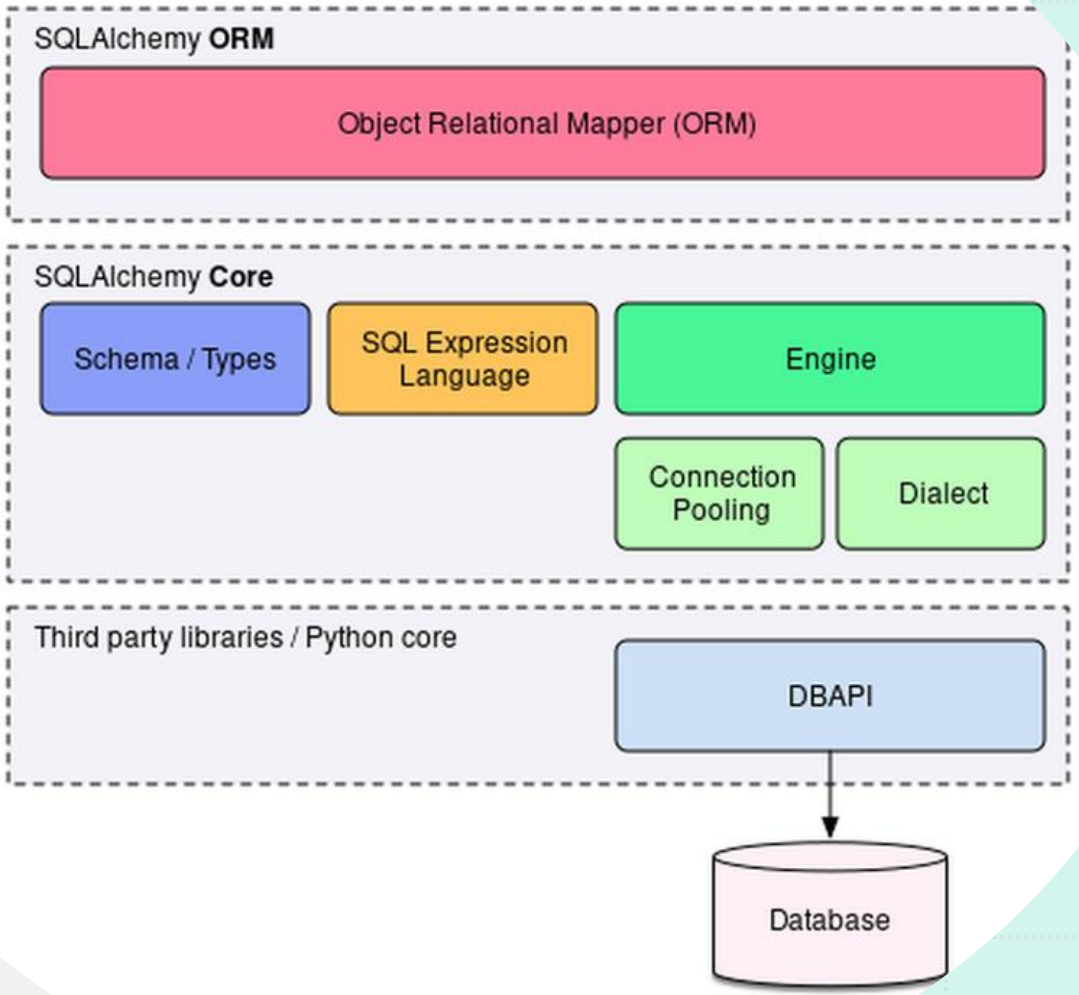
Dwa podstawowe modele użycia

SQLAlchemy składa się z dwóch API, jednym zbudowanym "na szczycie" drugiego:

1. **Core** aka SQL Expression Language

2. **ORM** (Object Relational Mapper)

Podstawowa architektura



Dialekty (+sterowniki)

SQLAlchemy 1.3 Documentation

Release: **1.3.12** CURRENT RELEASE | Release Date: December 16, 2

SQLAlchemy 1.3 Documentation

CURRENT RELEASE

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Search terms: search...

SQLite

Support for the SQLite database.

DBAPI Support

The following dialect/DBAPI options are available. Please refer to individual DBAPI sections for connect information.

- pysqlite
- pysqlcipher

Date and Time Types

SQLite does not have built-in DATE, TIME, or DATETIME types, and pysqlite does not
Python *datetime* objects and a SQLite-supported format. SQLAlchemy
when SQLite is used. The implementation classes are
also nicely support ordering. There's no

SQLAlchemy 1.3 Documentation

Release: **1.3.12** CURRENT RELEASE | Release Date: December 16

SQLAlchemy 1.3 Documentation

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PostgreSQL

Support for the PostgreSQL database.

DBAPI Support

The following dialect/DBAPI options are available. Please refer to individual DBAPI sections for connect information.

- psycopg2
- pg8000
- psycopg2cffi
- py-postgresql
- pygresql
- zxJDBC for Jython

Sequences/SERIAL/IDENTITY

SQLAlchemy 1.3 Documentation

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Search terms: search...

MySQL

Support for the MySQL database.

DBAPI Support

The following dialect/DBAPI options are available. Please refer to individual DBAPI sections for connect information.

- mysqlclient (maintained fork of MySQL-Python)
- PyMySQL
- MySQL Connector/Python
- CyMySQL
- OurSQL
- Google Cloud SQL
- PyODBC
- zxjdbc for Jython

Supported Versions

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Search terms: search...

Oracle

Support for the Oracle database.

DBAPI Support

The following dialect/DBAPI options are available. Please refer to individual DBAPI sections for connect information.

- cx-Oracle
- zxJDBC for Jython

Connect Arguments

The dialect supports several `create_engine()` arguments which affect the be

- `use_ansi` - Use ANSI JOIN constructs (see the se
- `optimize_limits` - defaults to

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Search terms: search...

Microsoft SQL Server

Support for the Microsoft SQL Server database.

DBAPI Support

The following dialect/DBAPI options are available. Please refer to individual DBAPI sections for connect information.

- PyODBC
- mxODBC
- pymssql
- zxJDBC for Jython
- adodbapi

Auto Increment Behavior / IDENTITY Col

SQL Server provides so-called “auto increm

Instalacja

Instalacja

```
(.venv) C:\Users\User\PycharmProjects\database_programming\mysql_connector_python\documentation>pip install sqlalchemy
```

Weryfikacja

```
(.venv) C:\Users\User\PycharmProjects\database_programming\mysql_connector_python\documentation>python
Python 3.11.1 (tags/v3.11.1:a7a450f, Dec  6 2022, 19:58:39) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import sqlalchemy
>>> sqlalchemy.__version__
'2.0.28'
```

Napis połączeniowy

(ang. connection string)

Definicja

Napis połączeniowy (ang. connection string) to napis zawierający wszystkie niezbędne informacje do połączenia z bazą danych. Wśród informacji znajdują się:

1. dialekt bazy (sqlite, postgresql, mysql, …)

2. sterownik (ang. connector aka driver) - biblioteka Pythona, która pozwala na pracę z konkretnym dialektem

3. lokalizacja i nazwa bazy

Anatomia

Postać pełna

```
dialect[+driver]://user:password@hostname/dbname[?key=value]
```

Przykłady

SQLite

(using *pysqlite* driver)

```
'sqlite:///db_name.db'
```

PostgreSQL

(using *psycopg2* driver)

```
'postgresql://xavier:postgres@localhost:5432/db_name'
```

MySQL

(using *mysql-connector-python* driver)

```
'mysql+mysqlconnector://root:mysql@localhost:3306/db_name'
```

Przykład mysql

```
cnx_string = "mysql+mysqlconnector://root:admin@localhost"
```

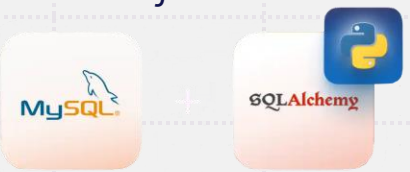
Silnik
(ang. Engine)

Opis

Silnik to obiekty klasy Engine w SQLAlchemy. Zapewnia połączenie z bazą oraz obsługuje operacje wykonywane na bazie. Jest centralnym źródłem połączeń z bazą. Stanowi fabrykę połączeń oraz zarządza pulą połączeń. Jest leniwy (leniwa inicjalizacja, ang. lazy initialization).

Połączenie z bazą wymaga przekazania do silnika napisu połączeniowego.

Zalecanym sposobem tworzenia obiektu klasy silnik jest funkcja create_engine.



Przykład inicjalizacji silnika

```python
from sqlalchemy import create_engine

cnx_string = "mysql+mysqlconnector://root:admin@localhost"
engine = create_engine(cnx_string)
```

*Funkcja **create_engine** tworzy obiekty klasy Engine*

```
def create_engine(url: Union[str, _url.URL], **kwargs: Any) -> Engine:
    """Create a new :class:`_engine.Engine` instance.

    The standard calling form is to send the :ref:`URL <database_urls>` as the
    first positional argument, usually a string
    that indicates database dialect and connection arguments::

        engine = create_engine("postgresql+psycopg2://scott:tiger@localhost/test")

    .. note::

        Please review :ref:`database_urls` for general guidelines in composing
        URL strings.  In particular, special characters, such as those often
        part of passwords, must be URL encoded to be properly parsed.

    Additional keyword arguments may then follow it which
    establish various options on the resulting :class:`_engine.Engine`
    and its underlying :class:`.Dialect` and :class:`_pool.Pool`
    constructs::

        engine = create_engine("mysql+mysqldb://scott:tiger@hostname/dbname",
                               pool_recycle=3600, echo=True)

    The string form of the URL is
ne()
```

*Klasa **Engine** komponuje się z obiektu klasy **Pool** (odpowiedzialnej za zarządzanie połączeniem) oraz obiektu klasy **Dialect** (odpowiedzialnej za generowanie poprawnych literałów SQL)*

```
class Engine(
    ConnectionEventsTarget, log.Identified, inspection.Inspectable["Inspector"]
):
...

    dialect: Dialect
    pool: Pool
    url: URL
    hide_parameters: bool

    def __init__(
        self,
        pool: Pool,
        dialect: Dialect,
        url: URL,
        logging_name: Optional[str] = None,
        echo: Optional[_EchoFlagType] = None,
        query_cache_size: int = 500,
        execution_options: Optional[Mapping[str, Any]] = None,
        hide_parameters: bool = False,
    ):
        self.pool = pool
        self.url = url
```

```
In [1]: from sqlalchemy import create_engine

In [2]: engine = create_engine("mysql+mysqlconnector://root:admin@localhost")

In [3]: print(dir(engine))
['__annotations__', '__class__', '__class_getitem__', '__delattr__', '__dict__', '__dir__', '__doc__', '__eq__', '__format__', '__ge__', '__getattribute__', '__getstate__', '__gt__
', '__hash__', '__init__', '__init_subclass__', '__le__', '__lt__', '__module__', '__ne__', '__new__', '__orig_bases__', '__parameters__', '__reduce__', '__reduce_ex__', '__repr__'
, '__setattr__', '__sizeof__', '__slots__', '__str__', '__subclasshook__', '__weakref__', '_compiled_cache', '_connection_cls', '_echo', '_execution_options', '_has_events', '_is_f
uture', '_is_protocol', '_lru_size_alert', '_option_cls', '_optional_conn_ctx_manager', '_run_ddl_visitor', '_schema_translate_map', '_should_log_debug', '_should_log_info', '_sqla
_logger_namespace', 'begin', 'clear_compiled_cache', 'connect', 'dialect', 'dispatch', 'dispose', 'driver', 'echo', 'engine',
ameters', 'logger', 'logging_name', 'name', 'pool', 'raw_connection', 'update_execution_options',
```

Klasa Engine

Wśród metod klasy ***Enigne*** znajduje się metoda ***connect***.

*Metoda **connect** zwraca obiekt klasy **Connection***

```
def connect(self) -> Connection:
    """Return a new :class:`_engine.Connection` object.

    The :class:`_engine.Connection` acts as a Python context manager, so
    the typical use of this method looks like::

        with engine.connect() as connection:
            connection.execute(text("insert into table values ('foo')"))
            connection.commit()

    Where above, after the block is completed, the connection is "closed"
    and its underlying DBAPI resources are returned to the connection pool.
    This also has the effect of rolling back any transaction that
    was explicitly begun or was begun via autobegin, and will
    emit the :meth:`_events.ConnectionEvents.rollback` event if one was
    started and is still in progress.

    .. seealso::

        :meth:`_engine.Engine.begin`

    """

    return self._connection_cls(self)
```

*Klasa **Connection** reprezentuje połączenie i jest menadżerem kontekstu*

```python
class Connection(ConnectionEventsTarget, inspection.Inspectable["Inspector"]):
    """Provides high-level functionality for a wrapped DB-API connection.

    The :class:`_engine.Connection` object is procured by calling the
    :meth:`_engine.Engine.connect` method of the :class:`_engine.Engine`
    object, and provides services for execution of SQL statements as well
    as transaction control.

    The Connection object is **not** thread-safe. While a Connection can be
    shared among threads using properly synchronized access, it is still
    possible that the underlying DBAPI connection may not support shared
    access between threads. Check the DBAPI documentation for details.

    The Connection object represents a single DBAPI connection checked out
    from the connection pool. In this state, the connection pool has no
    affect upon the connection, including its expiration or timeout state.
    For the connection pool to properly manage connections, connections
    should be returned to the connection pool (i.e. ``connection.close()``)
    whenever the connection is not in use.

    .. index::
      single: thread safety; Connection

    """

    dispatch: dispatcher[ConnectionEventsTarget]
```

```
In [1]: from sqlalchemy import create_engine

In [2]: engine = create_engine("mysql+mysqlconnector://root:admin@localhost")

In [3]: with engine.connect() as conn:
   ...:     print(dir(conn))
   ...:
['_Connection__can_reconnect', '_Connection__in_begin', '_Connection__savepoint_seq', '__annotations__', '__class__', '__class_getitem__', '__delattr__', '__dict__', '__dir__', '__
doc__', '__enter__', '__eq__', '__exit__', '__format__', '__ge__', '__getattribute__', '__getstate__', '__gt__', '__hash__', '__init__', '__init_subclass__', '__le__', '__lt__', '_
_module__', '__ne__', '__new__', '__orig_bases__', '__parameters__', '__reduce__', '__reduce_ex__', '__repr__', '__setattr__', '__sizeof__', '__slots__', '__str__', '__subclasshook
__', '__weakref__', '_allow_autobegin', '_autobegin', '_begin_impl', '_begin_twophase_impl', '_commit_impl', '_commit_twophase_impl', '_cursor_execute', '_dbapi_connection', '_echo
', '_exec_insertmany_context', '_exec_single_context', '_execute_clauseelement', '_execute_compiled', '_execute_context', '_execute_ddl', '_execute_default', '_execute_function', '
_execution_options', '_get_required_nested_transaction', '_get_required_transaction', '_handle_dbapi_exception', '_handle_dbapi_exception_noconnection', '_has_events', '_invalid_tr
ansaction', '_invoke_before_exec_event', '_is_autocommit_isolation', '_is_disconnect', '_is_protocol', '_log_debug', '_log_info', '_message_formatter', '_nested_transaction', '_pre
pare_twophase_impl', '_reentrant_error', '_release_savepoint_impl', '_revalidate_connection', '_rollback_impl', '_rollback_to_savepoint_impl', '_rollback_twophase_impl', '_run_ddl_
visitor', '_safe_close_cursor', '_savepoint_impl', '_schema_translate_map', '_sqla_logger_namespace', '_still_open_and_dbapi_connection_is_valid', '_trans_context_manager', '_trans
action', 'begin', 'begin_nested', 'begin_twophase', 'close', 'closed', 'commit', 'commit_prepared', 'connection', 'default_isolation_level',
e', 'exec_driver_sql', 'execute', 'execution_options', 'get_execution_options', 'get_isolation_level', 'get_nested_
nsaction', 'info', 'invalidate', 'invalidated', 'recover_twophase', 'rollback', 'rollback_pre
```

Klasa Connection

W klasie ***Connection*** rozpoznajemy dobrze już znane nam metody. Metoda ***execute*** zgodnie z DB-API jest składową kursora, ale tym razem kursor jest abstrakcją ukrytą przed użytkownikiem (*SQLAlchemy* nie jest sterownikiem)

Metoda execute

*Metoda **execute** zwraca obiekty klasy CursorResult*

```
def execute(
    self,
    statement: Executable,
    parameters: Optional[_CoreAnyExecuteParams] = None,
    *,
    execution_options: Optional[CoreExecuteOptionsParameter] = None,
) -> CursorResult[Any]:
    r"""Executes a SQL statement construct and returns a
    :class:`_engine.CursorResult`.

    :param statement: The statement to be executed.  This is always
     an object that is in both the :class:`_expression.ClauseElement` and
     :class:`_expression.Executable` hierarchies, including:

     * :class:`_expression.Select`
     * :class:`_expression.Insert`, :class:`_expression.Update`,
       :class:`_expression.Delete`
     * :class:`_expression.TextClause` and
       :class:`_expression.TextualSelect`
     * :class:`_schema.DDL` and objects which inherit from
       :class:`_schema.ExecutableDDLElement`

    :param parameters: parameters which will be bound into the statement.
```

*Klasa **CursorResult** reprezentuje wynik zwracany dla danego stanu kursora*

```
class CursorResult(Result[_T]):
    """A Result that is representing state from a DBAPI cursor.

    .. versionchanged:: 1.4  The :class:`.CursorResult``
       class replaces the previous :class:`.ResultProxy` interface.
       This classes are based on the :class:`.Result` calling API
       which provides an updated usage model and calling facade for
       SQLAlchemy Core and SQLAlchemy ORM.

    Returns database rows via the :class:`.Row` class, which provides
    additional API features and behaviors on top of the raw data returned by
    the DBAPI.   Through the use of filters such as the :meth:`.Result.scalars`
    method, other kinds of objects may also be returned.

    .. seealso::

        :ref:`tutorial_selecting_data` - introductory material for accessing
        :class:`_engine.CursorResult` and :class:`.Row` objects.

    """

    __slots__ = (
        "context",
        "dialect",
        "cursor",
```

```
['__annotations__', '__class__', '__class_getitem__', '__delattr__', '__dict__', '__dir__', '__doc__', '__enter__', '__eq__', '__exit__', '__format__', '__ge__',
 '__getattribute__', '__getstate__', '__gt__', '__hash__', '__init__', '__init_subclass__', '__iter__', '__le__', '__lt__', '__module__', '__ne__', '__new__', '__next__',
 '__orig_bases__', '__parameters__', '__reduce__', '__reduce_ex__', '__repr__', '__setattr__', '__sizeof__', '__slots__', '__str__', '__subclasshook__', '_allrows',
 '_assert_no_memoizations', '_attributes', '_column_slices', '_echo', '_fetchall_impl', '_fetchiter_impl', '_fetchmany_impl', '_fetchone_impl', '_generate', '_generate_rows',
  '_getter', '_init_metadata', '_is_cursor', '_is_protocol', '_iter_impl', '_iterator_getter', '_manyrow_getter', '_memoized_keys', '_metadata', '_next_impl',
 '_no_result_metadata', '_onerow_getter', '_only_one_row', '_post_creational_filter', '_raw_all_rows', '_raw_row_iterator', '_real_result', '_reset_memoizations', '_rewind',
 '_row_getter', '_row_logging_fn', '_set_memoized_attribute', '_soft_close', '_soft_closed', '_source_supports_scalars', '_tuple_getter', '_unique_filter_state',
 '_unique_strategy', '_yield_per', 'all', 'close', 'closed', 'columns', 'connection', 'context', 'cursor', 'cursor_strategy', 'dialect', 'fetchall', 'fetchmany', 'fetchone',
 'first', 'freeze', 'inserted_primary_key', 'inserted_primary_key_rows', 'is_insert', 'keys', 'last_inserted_params', 'last_updated_params', 'lastrow_has_defaults',
 'lastrowid', 'mappings', 'memoized_attribute', 'memoized_instancemethod', 'merge', 'one', 'one_or_none', 'partitions', 'postfetch_cols', 'prefetch_cols',
 'returned_defaults', 'returned_defaults_rows', 'returns_rows', 'rowcount', 'scalar', 'scalar_one', 'scalar_one_or_none',
 'splice_vertically', 'supports_sane_multi_rowcount', 'supports_sane_rowcount', 't',
```

Klasa CursorResult

W klasie *CursorResult* rozpoznajemy dobrze już znane nam funkcje.

Funckja text

Wykonywanie surowych zapytań

Opis

```python
from sqlalchemy import create_engine, text

cnx_string = "mysql+mysqlconnector://root:admin@localhost"
engine = create_engine(cnx_string)

stmt = text("""CREATE DATABASE IF NOT EXISTS company_db;""")

with engine.connect() as cnx:
    cnx.execute(stmt)
```

*Funkcja **text** tworzy obiekty klasy TextClause*

```
@_document_text_coercion( paramname: "text",  meth_rst: ":func:`.text`",  param_rst: ":paramref:`.text.text`")
def text(text: str) -> TextClause:
    r"""Construct a new :class:`_expression.TextClause` clause,
    representing
    a textual SQL string directly.

    E.g.::

        from sqlalchemy import text

        t = text("SELECT * FROM users")
        result = connection.execute(t)

    The advantages :func:`_expression.text`
    provides over a plain string are
    backend-neutral support for bind parameters, per-statement
    execution options, as well as
    bind parameter and result-column typing behavior, allowing
    SQLAlchemy type constructs to play a role when executing
    a statement that is specified literally.  The construct can also
    be provided with a ``.c`` collection of column elements, allowing
    it to be embedded in other SQL expression constructs as a subquery.

    Bind parameters are specified by name, using the format ``:name``.
```

*Klasa **TextClause** reprezentuje literał SQL*

```
class TextClause(
    roles.DDLConstraintColumnRole,
    roles.DDLExpressionRole,
    roles.StatementOptionRole,
    roles.WhereHavingRole,
    roles.OrderByRole,
    roles.FromClauseRole,
    roles.SelectStatementRole,
    roles.InElementRole,
    Generative,
    Executable,
    DQLDMLClauseElement,
    roles.BinaryElementRole[Any],
    inspection.Inspectable["TextClause"],
):
    """Represent a literal SQL text fragment.

    E.g.::

        from sqlalchemy import text

        t = text("SELECT * FROM users")
        result = connection.execute(t)
```

Emitowanie wygenerowanych zapytań sql

```python
from sqlalchemy import create_engine

cnx_string = "mysql+mysqlconnector://root:admin@localhost"
engine = create_engine(cnx_string, echo=True)
```

```
C:\Users\User\PycharmProjects\database_programming\.venv\Scripts\python.exe "C:\Users\User\PycharmProjects\databa
2024-03-12 06:30:37,938 INFO sqlalchemy.engine.Engine SELECT DATABASE()
2024-03-12 06:30:37,938 INFO sqlalchemy.engine.Engine [raw sql] {}
2024-03-12 06:30:37,940 INFO sqlalchemy.engine.Engine SELECT @@sql_mode
2024-03-12 06:30:37,940 INFO sqlalchemy.engine.Engine [raw sql] {}
2024-03-12 06:30:37,941 INFO sqlalchemy.engine.Engine SELECT @@lower_case_table_names
2024-03-12 06:30:37,941 INFO sqlalchemy.engine.Engine [raw sql] {}
2024-03-12 06:30:37,942 INFO sqlalchemy.engine.Engine BEGIN (implicit)
2024-03-12 06:30:37,942 INFO sqlalchemy.engine.Engine CREATE DATABASE IF NOT EXISTS company_db;
2024-03-12 06:30:37,942 INFO sqlalchemy.engine.Engine [generated in 0.00031s] {}
2024-03-12 06:30:37,943 INFO sqlalchemy.engine.Engine ROLLBACK

Process finished with exit code 0
```

Parametry związane (*ang. bounded parameters*)

colon format

```
stmt = text("""
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(:fn, :ln, :pos, :sal)
;""")
employees = [
    {'fn': 'John', 'ln': 'Doe', 'pos': 'Manager', 'sal': 5000.00},
    {'fn': 'Jane', 'ln': 'Smith', 'pos': 'Developer', 'sal': 4000.00},
    {'fn': 'Alice', 'ln': 'Johnson', 'pos': 'HR', 'sal': 4500.00}
]

with engine.connect() as conn:
    conn.execute(stmt, employees)
    conn.commit()
print("Done.")
```

pyformat (jeden z 5 dopuszczalnych formatów w DB-API, zależy od użytego sterownika)

```
2024-03-12 12:13:50,916 INFO sqlalchemy.engine.Engine INSERT INTO employee (first_name, last_name, position, salary) VALUES (%(first_name_m0)s,
 %(last_name_m0)s, %(position_m0)s, %(salary_m0)s), (%(first_name_m1)s, %(last_name_m1)s, %(position_m1)s, %(salary_m1)s), (%(first_name_m2)s,
 %(last_name_m2)s, %(position_m2)s, %(salary_m2)s)
2024-03-12 12:13:50,916 INFO sqlalchemy.engine.Engine [no key 0.00033s] {'first_name_m0': 'John', 'last_name_m0': 'Doe', 'position_m0':
 'Manager', 'salary_m0': 5000.0, 'first_name_m1': 'Jane', 'last_name_m1': 'Smith', 'position_m1': 'Developer', 'salary_m1': 4000.0,
 'first_name_m2': 'Alice', 'last_name_m2': 'Johnson', 'position_m2': 'HR', 'salary_m2': 4500.0}
2024-03-12 12:13:50,954 INFO sqlalchemy.engine.Engine COMMIT
```

Dwa style

No autocommit

```
stmt = text("""
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(:fn, :ln, :pos, :sal)
;""")
employees = [
    {'fn': 'John', 'ln': 'Doe', 'pos': 'Manager', 'sal': 5000.00},
    {'fn': 'Jane', 'ln': 'Smith', 'pos': 'Developer', 'sal': 4000.00},
]

employees2 = [
    {'fn': 'Alice', 'ln': 'Johnson', 'pos': 'HR', 'sal': 4500.00}
]

with engine.connect() as conn:
    conn.execute(stmt, employees)
    conn.execute(stmt, employees2)

print("Done.")
```

No autocommit

```
2024-03-12 07:19:42,104 INFO sqlalchemy.engine.Engine BEGIN (implicit)
2024-03-12 07:19:42,104 INFO sqlalchemy.engine.Engine
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(%(fn)s, %(ln)s, %(pos)s, %(sal)s)
;
2024-03-12 07:19:42,104 INFO sqlalchemy.engine.Engine [generated in 0.00034s] [{'fn': 'John', 'ln': 'Doe', 'pos': 'Manager', 'sal': 5000.0}, {'fn':
  4000.0}]
2024-03-12 07:19:42,105 INFO sqlalchemy.engine.Engine
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(%(fn)s, %(ln)s, %(pos)s, %(sal)s)
;
2024-03-12 07:19:42,105 INFO sqlalchemy.engine.Engine [generated in 0.00025s] {'fn': 'Alice', 'ln': 'Johnson', 'pos': 'HR', 'sal': 4500.0}
2024-03-12 07:19:42,106 INFO sqlalchemy.engine.Engine ROLLBACK
Done.
```

So ?

1. Commit as you go

```python
stmt = text("""
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(:fn, :ln, :pos, :sal)
;""")
employees = [
    {'fn': 'John', 'ln': 'Doe', 'pos': 'Manager', 'sal': 5000.00},
    {'fn': 'Jane', 'ln': 'Smith', 'pos': 'Developer', 'sal': 4000.00},
]

employees2 = [
    {'fn': 'Alice', 'ln': 'Johnson', 'pos': 'HR', 'sal': 4500.00}
]

with engine.connect() as conn:
    conn.execute(stmt, employees)
    conn.commit()
    conn.execute(stmt, employees2)
    conn.commit()

print("Done.")
```

1. Commit as you go

```
2024-03-12 07:14:25,794 INFO sqlalchemy.engine.Engine BEGIN (implicit)
2024-03-12 07:14:25,794 INFO sqlalchemy.engine.Engine
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(%(fn)s, %(ln)s, %(pos)s, %(sal)s)
;
2024-03-12 07:14:25,794 INFO sqlalchemy.engine.Engine [generated in 0.00040s] [{'fn': 'John', 'ln': 'Doe', 'pos': 'Manager', 'sal': 5000.0}, {'f
  4000.0}]
2024-03-12 07:14:25,795 INFO sqlalchemy.engine.Engine COMMIT
2024-03-12 07:14:25,798 INFO sqlalchemy.engine.Engine BEGIN (implicit)
2024-03-12 07:14:25,798 INFO sqlalchemy.engine.Engine
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(%(fn)s, %(ln)s, %(pos)s, %(sal)s)
;
2024-03-12 07:14:25,798 INFO sqlalchemy.engine.Engine [generated in 0.00036s] {'fn': 'Alice', 'ln': 'Johnson', 'pos'          al': 450
2024-03-12 07:14:25,798 INFO sqlalchemy.engine.Engine COMMIT
Done.
```

Or

2. Begin once

```
stmt = text("""
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(:fn, :ln, :pos, :sal)
;""")
employees = [
    {'fn': 'John', 'ln': 'Doe', 'pos': 'Manager', 'sal': 5000.00},
    {'fn': 'Jane', 'ln': 'Smith', 'pos': 'Developer', 'sal': 4000.00},
]

employees2 = [
    {'fn': 'Alice', 'ln': 'Johnson', 'pos': 'HR', 'sal': 4500.00}
]

with engine.begin() as conn:
    conn.execute(stmt, employees)
    conn.execute(stmt, employees2)

print("Done.")
```

2. Begin once

```
2024-03-12 07:16:12,514 INFO sqlalchemy.engine.Engine BEGIN (implicit)
2024-03-12 07:16:12,515 INFO sqlalchemy.engine.Engine
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(%(fn)s, %(ln)s, %(pos)s, %(sal)s)
;
2024-03-12 07:16:12,515 INFO sqlalchemy.engine.Engine [generated in 0.00025s] [{'fn': 'John', 'ln': 'Doe', 'pos': 'Manager', 'sal': 500(
  4000.0}]
2024-03-12 07:16:12,516 INFO sqlalchemy.engine.Engine
INSERT INTO employee(first_name, last_name, position, salary) VALUE
(%(fn)s, %(ln)s, %(pos)s, %(sal)s)
;
2024-03-12 07:16:12,516 INFO sqlalchemy.engine.Engine [generated in 0.00021s] {'fn': 'Alice', 'ln': 'Johnson', 'pos': 'HR', 'sal': 4500.
2024-03-12 07:16:12,516 INFO sqlalchemy.engine.Engine COMMIT
Done.
```

Klasa Row

*Iterując po obiekcie klasy **CursorResult** otrzymujemy obiekty klasy **Row**.*

```
class Row(BaseRow, Sequence[Any], Generic[_TP]):
    """Represent a single result row.

    The :class:`.Row` object represents a row of a database result.  It is
    typically associated in the 1.x series of SQLAlchemy with the
    :class:`_engine.CursorResult` object, however is also used by the ORM for
    tuple-like results as of SQLAlchemy 1.4.

    The :class:`.Row` object seeks to act as much like a Python named
    tuple as possible.   For mapping (i.e. dictionary) behavior on a row,
    such as testing for containment of keys, refer to the :attr:`.Row._mapping`
    attribute.

    .. seealso::

        :ref:`tutorial_selecting_data` - includes examples of selecting
        rows from SELECT statements.

    .. versionchanged:: 1.4

        Renamed ``RowProxy`` to :class:`.Row`. :class:`.Row` is no longer a
```

*Obiekty klasy **Row** reprezentują pojedynczy rekord result set-a i zachowują się jak krotka nazwana (ang. named tuple)*

```python
from sqlalchemy import create_engine, select
from tables import employee_table

engine = create_engine('mysql+mysqlconnector://root:admin@localhost/company_db')

stmt = select(employee_table)
with engine.connect() as cnx:
    result = cnx.execute(stmt)
    for id_, first_name, last_name, position, salary in result:  # NamedTuple - tuple assignment
        print(f"{first_name} {last_name} ({position}) [{salary}]")
```

*Obiekty klasy **Row** reprezentują pojedynczy rekord result set-a i zachowują się jak krotka nazwana (ang. named tuple)*

```python
from sqlalchemy import create_engine, select
from tables import employee_table

engine = create_engine('mysql+mysqlconnector://root:admin@localhost/company_db')

stmt = select(employee_table)
with engine.connect() as cnx:
    result = cnx.execute(stmt)
    for row in result:
        print(f"{row[1]} {row[2]} ({row[3]}) [{row[4]}]")  # NamedTuple - Integer index
```

*Obiekty klasy **Row** reprezentują pojedynczy rekord result set-a i zachowują się jak krotka nazwana (ang. named tuple)*

```python
from sqlalchemy import create_engine, select
from tables import employee_table

engine = create_engine('mysql+mysqlconnector://root:admin@localhost/company_db')

stmt = select(employee_table)
with engine.connect() as cnx:
    result = cnx.execute(stmt)
    for row in result:
        print(f"{row.first_name} {row.last_name} ({row.position}) [{row.salary}]")  # NamedTuple - attribute name
```

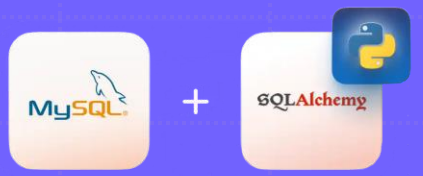
*Obiekty klasy **Row** reprezentują pojedynczy rekord result set-a i zachowują się jak krotka nazwana (ang. named tuple)*

```python
from sqlalchemy import create_engine, select
from tables import employee_table

engine = create_engine('mysql+mysqlconnector://root:admin@localhost/company_db')

stmt = select(employee_table)
with engine.connect() as cnx:
    result = cnx.execute(stmt)
    for row in result.mappings():  # NamedTuple - mapping access
        print(f"{row.get('first_name')} {row.get('last_name')} ({row.get('position')}) [{row.get('salary')}]")
```

SQLAlchemy Core



SQLAlchemy Expression Language

SQLAlchemy posiada zestaw python-owych narzędzi do komunikacji z bazą danych bez potrzeby bezpośredniego pisania zapytań SQL. ***SQLAlchemy Expression Language*** *(język wyrażeń SQLAlchemy), bo tak jest nazywany ten zestaw, to klasy, metody oraz funkcje, których wywołania mapowane są na odpowiednie instrukcje SQL i tak wygenerowane zapytania SQL są wysyłane do bazy. W ten sposób nie pisząc nawet jednej linijki kodu SQL można wykonać na bazie większość tradycyjnych operacji.*

Instrukcje DDL

Struktury bazodanowe

Struktury bazodanowe są reprezentowane w SQLAlchemy Expression Language przez klasy takie jak:

1. Metadata

2. Table

3. Column

4. SQL Datatype Objects (takie jak Integer, String, ...)

i są nazywane kolektywnie metadanymi bazy danych (ang. databasbe metadata).

1. Metadata

*Klasa **Metadata** jest kolekcją, w której przechowujemy wszystkie informacje na temat istniejących w bazie struktur. Stanowi fasadę na python-owy słownik, którego kluczami są nazwy tabel, a wartościami obiekty reprezentujące te tabele (czyli obiekty klasy Table)*

Inicjalizacja obiektu klasy ***Metadata***.

```
from sqlalchemy import create_engine
from sqlalchemy import MetaData

cnx_string = "mysql+mysqlconnector://root:admin@localhost/company_db"
engine = create_engine(cnx_string)

metadata = MetaData()
```

1. Metadata

```
class MetaData(HasSchemaAttr):
    """A collection of :class:`_schema.Table`
    objects and their associated schema
    constructs.

    Holds a collection of :class:`_schema.Table` objects as well as
    an optional binding to an :class:`_engine.Engine` or
    :class:`_engine.Connection`.  If bound, the :class:`_schema.Table` objects
    in the collection and their columns may participate in implicit SQL
    execution.

    The :class:`_schema.Table` objects themselves are stored in the
    :attr:`_schema.MetaData.tables` dictionary.

    :class:`_schema.MetaData` is a thread-safe object for read operations.
    Construction of new tables within a single :class:`_schema.MetaData`
    object,
    either explicitly or via reflection, may not be completely thread-safe.

    .. seealso::

        :ref:`metadata_describing` - Introduction to database metadata

    """
```

2. Table

*Klasa **Table** reprezentuje bazodanową tablicę. Komponuje się z obiektów klasy Column.*

Inicjalizacja obiektu klasy ***Table***.

```
from sqlalchemy import create_engine
from sqlalchemy import MetaData, Table, Column, Integer, String, Float

cnx_string = "mysql+mysqlconnector://root:admin@localhost/company_db"
engine = create_engine(cnx_string)

metadata = MetaData()


employee_table = Table(
     name: 'employee',
    metadata,
     *args: Column( __name_pos: 'id', Integer, primary_key=True),
    Column( __name_pos: 'first_name', String(50)),
    Column( __name_pos: 'last_name', String(100)),
    Column( __name_pos: 'position', String(100)),
    Column( __name_pos: 'salary', Float)
)
```

2. Table

```
class Table(
    DialectKWArgs, HasSchemaAttr, TableClause, inspection.Inspectable["Table"]
):
    r"""Represent a table in a database.

    e.g.::

        mytable = Table(
            "mytable", metadata,
            Column('mytable_id', Integer, primary_key=True),
            Column('value', String(50))
        )

    The :class:`_schema.Table`
    object constructs a unique instance of itself based
    on its name and optional schema name within the given
    :class:`_schema.MetaData` object. Calling the :class:`_schema.Table`
    constructor with the same name and same :class:`_schema.MetaData` argument
    a second time will return the *same* :class:`_schema.Table`
    object - in this way
    the :class:`_schema.Table` constructor acts as a registry function.

    .. seealso::

        :ref:`metadata_describing` - Introduction to database metadata

    """

    __visit_name__ = "table"
```

3. Column

*Klasa **Column** reprezentuje pojedynczą kolumnę w tabeli. Komponuje się z obiektów klas reprezentujących typ danych SQL (takich jak Integer, String...) oraz obiektów klas reprezentujących więzy (takich jak PrimaryKeyConstraint, UniqueConstraint, ...)*

Inicjalizacja obiektu klasy ***Column***.

```
from sqlalchemy import create_engine
from sqlalchemy import MetaData, Table, Column, Integer, String, Float

cnx_string = "mysql+mysqlconnector://root:admin@localhost/company_db"
engine = create_engine(cnx_string)

metadata = MetaData()



employee_table = Table(
     name: 'employee',
    metadata,
     *args: Column( __name_pos: 'id', Integer, primary_key=True),
    Column( __name_pos: 'first_name', String(50)),
    Column( __name_pos: 'last_name', String(100)),
    Column( __name_pos: 'position', String(100)),
    Column( __name_pos: 'salary', Float)
)
```

3. Column

```python
class Column(DialectKWArgs, SchemaItem, ColumnClause[_T]):
    """Represents a column in a database table."""

    __visit_name__ = "column"

    inherit_cache = True
    key: str

    server_default: Optional[FetchedValue]

    def __init__(
        self,
        __name_pos: Optional[
            Union[str, _TypeEngineArgument[_T], SchemaEventTarget]
        ] = None,
        __type_pos: Optional[
            Union[_TypeEngineArgument[_T], SchemaEventTarget]
        ] = None,
        *args: SchemaEventTarget,
        name: Optional[str] = None,
        type_: Optional[_TypeEngineArgument[_T]] = None,
        autoincrement: _AutoIncrementType = "auto",
        default: Optional[Any] = None,
        doc: Optional[str] = None,
        key: Optional[str] = None,
        index: Optional[bool] = None,
        unique: Optional[bool] = None,
        info: Optional[_InfoType] = None,
        nullable: Optional[
            Union[bool, Literal[SchemaConst.NULL_UNSPECIFIED]]
```

4. SQL DataType Objects

SQLAlchemy posiada bogaty zbiór klas reprezentujący poszczególne typy danych w SQL. Wszystkie te klasy dziedziczą po wspólnej nadklasie ***TypeEngine****. Hierarchia typów w SQLAlchemy wyróżnia dwie kategorie tych typów:*

1. Typy danych "CamelCase"

2. Typy danych "UPPERCASE"

4a CamelCase datatypes

Jest to zbiór najbardziej powszechnych typów danych jakie występują w relacyjnych bazach danych. Obiekty tych klas są rzutowane na odpowiadający im typ w konkretnym RDBMS (np. String w MySQL zostanie zrzutowany na VARCHAR, a w Oracle na NVARCHAR). Należą do nich

BigInteger	Enum	Interval	PickleType	Text	Uuid
Boolean	Double	LargeBinary	SchemaType	Time	
Date	Float	MatchType	SmallInteger	Unicode	
DateTime	Integer	Numeric	String	UnicodeText	

4b UPPERCASE datatypes

W odróżnieniu od typów danych CamelCase jest to zbiór klas reprezentujących konkretny typ danych. Nazwa klasy jest powiązana w jednoznaczny sposób z konkretnym typem SQL. Użycie klasy jest równoznaczne z użyciem typu danych SQL o nazwie tej klasy, niezależnie od tego z jakim RDBMS pracujemy. Możliwa jest sytuacja, w której RDBMS nieobsługuje użytego przez nas typu. W takim przypadku wystąpi błąd. Należą do nich:

ARRAY	BOOLEAN	DATETIME	FLOAT	NCHAR	SMALLINT	UUID
BIGINT	CHAR	DECIMAL	INT	NVARCHAR	TEXT	VARBINARY
BINARY	CLOB	DOUBLE	JSON	NUMERIC	TIME	VARCHAR
BLOB	DATE	DOUBLE_PRECISION	INTEGER	REAL	TIMESTAMP	

```
>>> from sqlalchemy import MetaData
>>> metadata = MetaData()
>>> print(dir(metadata))
['__annotations__', '__class__', '__class_getitem__', '__contains__', '__delattr__', '__dict__', '__dir__', '__d
oc__', '__eq__', '__format__', '__ge__', '__getattribute__', '__getstate__', '__gt__', '__hash__', '__init__', '
__init_subclass__', '__le__', '__lt__', '__module__', '__ne__', '__new__', '__reduce__', '__reduce_ex__', '__rep
r__', '__setattr__', '__setstate__', '__sizeof__', '__slots__', '__str__', '__subclasshook__', '__visit_name__',
 '__weakref__', '_add_table', '_compiler_dispatch', '_fk_memos', '_generate_compiler_dispatch', '_init_items', '
_original_compiler_dispatch', '_remove_table', '_schema_item_copy', '_schemas', '_sequences', '_set_parent', '_s
et_parent_with_dispatch', '_use_schema_map', 'clear', 'create_all', 'create_drop_stringify_dialect', 'dispatch',
 'drop_all', 'info', 'naming_convention', 'reflect', 'remove', 'schema'
```

Metody klasy Metadata

Wysyłanie instrukcji DDL:

- *create_all*
- *drop_all*