Working with Databases in Python 3

Using an ORM - SQLAlchemy

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Overview

ORM

- Object Relational Mapper
- Creates a mapping between objects and tables

SQLAlchemy

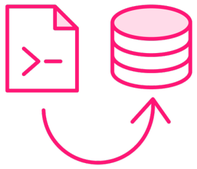
- Core API
- ORM

Model Classes

Relationships

Use the same code with more than one database

What is an ORM?



Object Relational Mapper

Work with a relational database using a general purpose language

Write your entire application in a single language

Connect to multiple databases

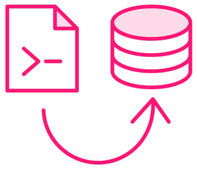
In Previous Episodes

Connect to the database

Send SQL to the server

Wait for the results

What is an ORM?



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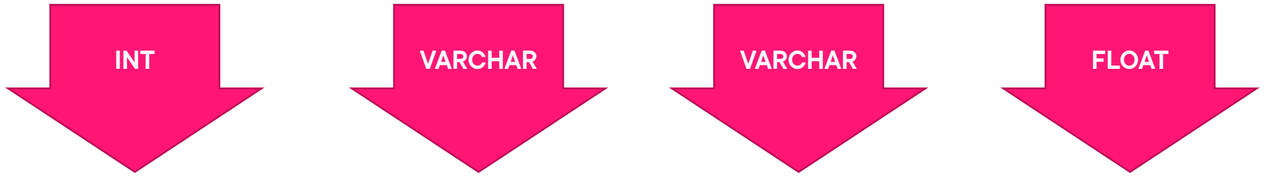
Object Relational Mapper



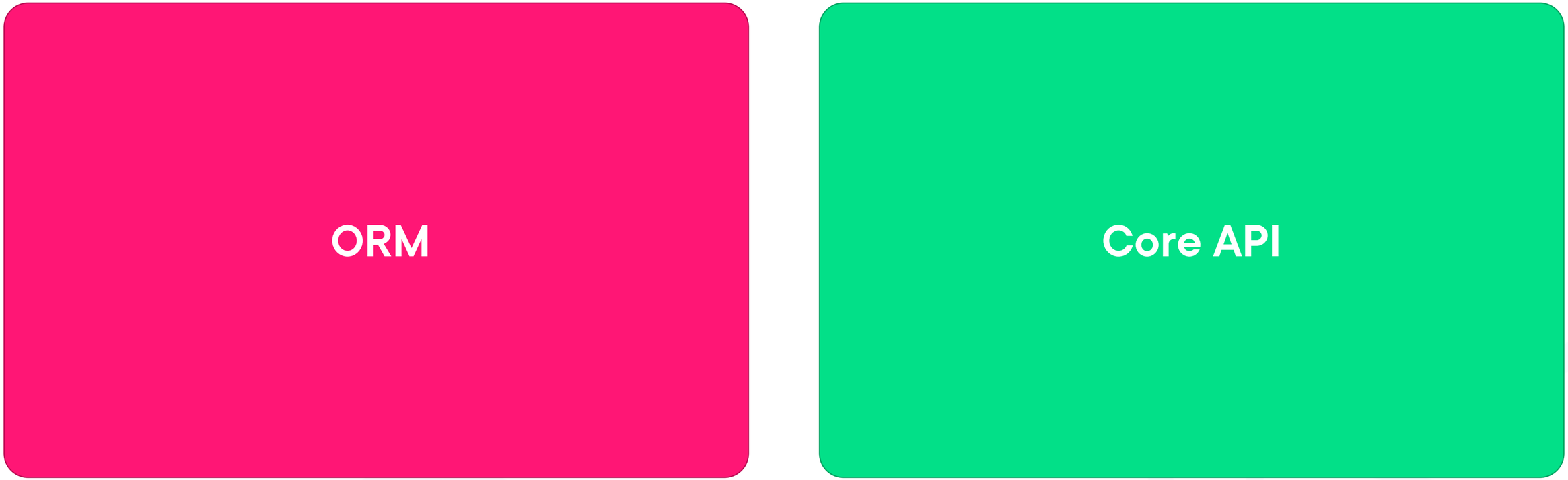
id	coin	currency	amount
1	bitcoin	USD	1.0
2	ethereum	GBP	10.0
3	dogecoin	EUR	100.0

```
INSERT INTO
investment (coin, currency, amount)
VALUES (‘bitcoin’, ‘USD’, 1.0);
```

```
class Investment:
    id: int
    coin: str
    currency: str
    amount: float
```

```
bitcoin = Investment(
    coin=“bitcoin”
    currency=“USD”,
    amount=1.0)
```

Two Sides of the Same API

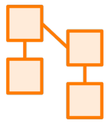


Don’t forget the docs!

https://docs.sqlalchemy.org/en/20/

Using SQLAlchemy

Distributed as a Python package



All model classes must inherit from `DeclarativeBase`

Attribute to column mappings are defining using type annotations

An engine connects to the database

A session is used to interact with the database

Implementing a Model Class

```
from sqlalchemy.orm import DeclarativeBase

class Base(DeclarativeBase):
    pass
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class Investment(Base):
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Implementing a Model Class

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from sqlalchemy.orm import DeclarativeBase

class Base(DeclarativeBase):
    pass

class Investment(Base):
    __tablename__ = “investment”
```

Implementing a Model Class

```
from sqlalchemy.orm import DeclarativeBase, Mapped

class Base(DeclarativeBase):
    pass

class Investment(Base):
    __tablename__ = “investment”
```

Implementing a Model Class

```
from sqlalchemy.orm import DeclarativeBase, Mapped

class Base(DeclarativeBase):
    pass

class Investment(Base):
    __tablename__ = “investment”
    id: Mapped[int]
```

Implementing a Model Class

```
from sqlalchemy.orm import DeclarativeBase, Mapped, mapped_column

class Base(DeclarativeBase):
    pass

class Investment(Base):
    __tablename__ = “investment”
    id: Mapped[int] = mapped_column()
```

Implementing a Model Class

```
from sqlalchemy.orm import DeclarativeBase, Mapped, mapped_column

class Base(DeclarativeBase):
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class Investment(Base):
    __tablename__ = “investment”
    id: Mapped[int] = mapped_column(primary_key=True)
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Implementing a Model Class

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from sqlalchemy.orm import DeclarativeBase, Mapped, mapped_column

class Base(DeclarativeBase):
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class Investment(Base):
    __tablename__ = “investment”
    id: Mapped[int] = mapped_column(primary_key=True)
    coin: Mapped[str] = mapped_column()
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```

Implementing a Model Class

```
from sqlalchemy import String
from sqlalchemy.orm import DeclarativeBase, Mapped, mapped_column

class Base(DeclarativeBase):
    pass

class Investment(Base):
    __tablename__ = “investment”
    id: Mapped[int] = mapped_column(primary_key=True)
    coin: Mapped[str] = mapped_column(String(32))
    currency: Mapped[str] = mapped_column(String(3))
    amount: Mapped[float] = mapped_column()
```

Implementing a Model Class

```
from sqlalchemy import String, Numeric
from sqlalchemy.orm import DeclarativeBase, Mapped, mapped_column

class Base(DeclarativeBase):
    pass

class Investment(Base):
    __tablename__ = “investment”
    id: Mapped[int] = mapped_column(primary_key=True)
    coin: Mapped[str] = mapped_column(String(32))
    currency: Mapped[str] = mapped_column(String(3))
    amount: Mapped[float] = mapped_column(Numeric(5, 2))
```

Model Classes and the Database

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from sqlalchemy import create_engine
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from sqlalchemy import create_engine

engine = create_engine(“sqlite:///data.db”)
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Model Classes and the Database

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from sqlalchemy import create_engine

engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)
```

Model Classes and the Database

```
from sqlalchemy import create_engine

engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)

bitcoin = Investment(coin=“bitcoin”, currency=“USD”, amount=1.0)
```

Model Classes and the Database

```
from sqlalchemy import create_engine
from sqlalchemy.orm import Session

engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)

bitcoin = Investment(coin=“bitcoin”, currency=“USD”, amount=1.0)

with Session(engine) as session:
```

Model Classes and the Database

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engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)

bitcoin = Investment(coin=“bitcoin”, currency=“USD”, amount=1.0)

with Session(engine) as session:
    session.add(bitcoin)
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engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)

bitcoin = Investment(coin=“bitcoin”, currency=“USD”, amount=1.0)

with Session(engine) as session:
    session.add(bitcoin)
    session.commit()
```

Model Classes and the Database

```
from sqlalchemy import create_engine, select
from sqlalchemy.orm import Session

engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)

bitcoin = Investment(coin=“bitcoin”, currency=“USD”, amount=1.0)

with Session(engine) as session:
    session.add(bitcoin)
    session.commit()

    stmt = select(Investment)
```

Model Classes and the Database

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from sqlalchemy import create_engine, select
from sqlalchemy.orm import Session

engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)

bitcoin = Investment(coin=“bitcoin”, currency=“USD”, amount=1.0)

with Session(engine) as session:
    session.add(bitcoin)
    session.commit()

    stmt = select(Investment).where(Investment.coin == “bitcoin”)
```

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from sqlalchemy import create_engine, select
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engine = create_engine("sqlite:///data.db")
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bitcoin = Investment(coin="bitcoin", currency="USD", amount=1.0)

with Session(engine) as session:
    session.add(bitcoin)
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    stmt = select(Investment).where(Investment.coin == "bitcoin")
    bitcoin = session.execute(stmt).scalar_one()
```

Model Classes and the Database

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from sqlalchemy import create_engine, select
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engine = create_engine(“sqlite:///data.db”)
Base.metadata.create_all(engine)

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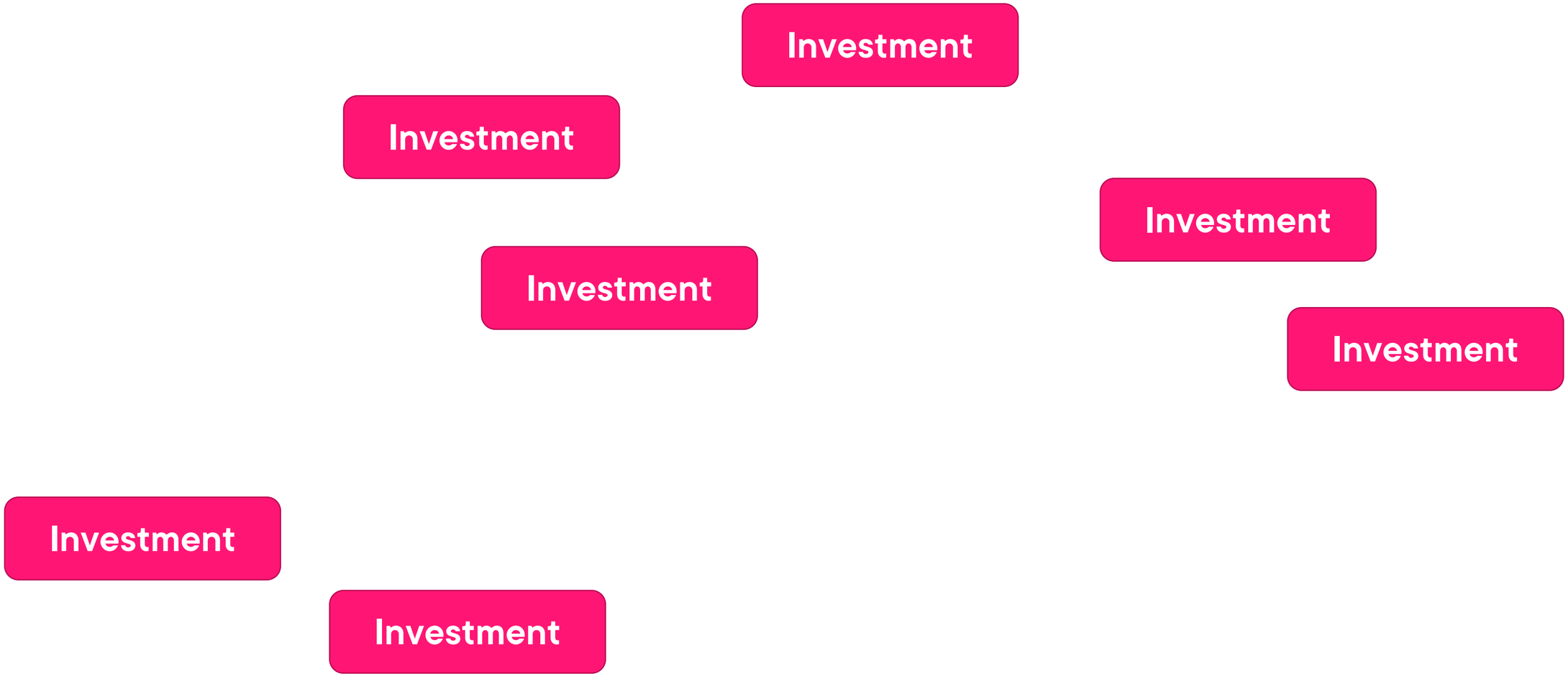
with Session(engine) as session:
    session.add(bitcoin)
    session.commit()

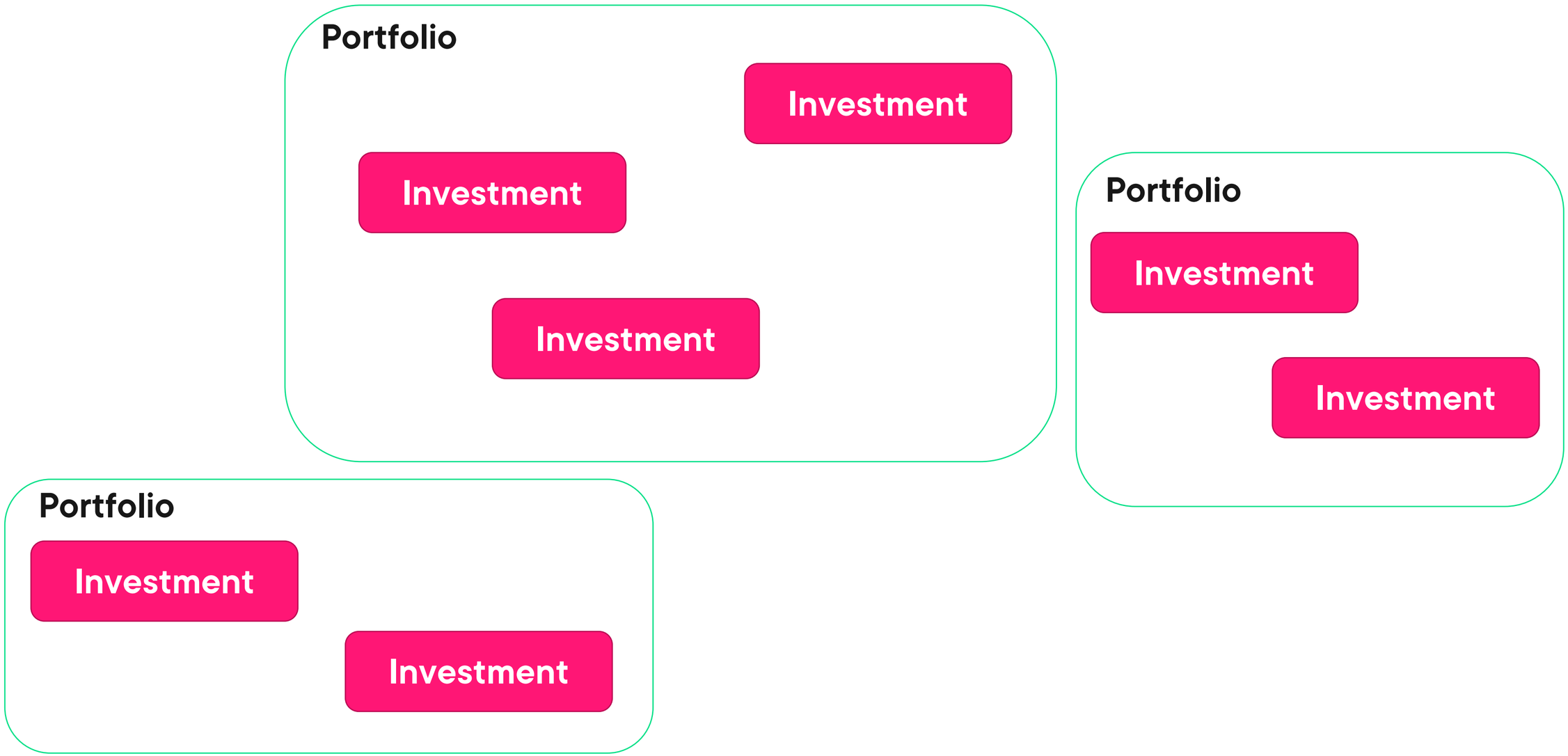
    stmt = select(Investment).where(Investment.coin == “bitcoin”)
    bitcoin = session.execute(stmt).scalar_one()

    print(f”{bitcoin.coin} - {bitcoin.currency} - {bitcoin.amount}”)
```

Relationships



Relationships



Portfolio Model Class

```
class Portfolio(Base):
    __tablename__ = “portfolio”
    id: Mapped[int] = mapped_column(primary_key=True)
    name: Mapped[str] = mapped_column(String(256))
    description: Mapped[str] = mapped_column(Text())
```

Portfolio Model Class

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    id: Mapped[int] = mapped_column(primary_key=True)
    name: Mapped[str] = mapped_column(String(256))
    description: Mapped[str] = mapped_column(Text())

    investment_coin_1: Mapped[str] = mapped_column(String(32))
    investment_currency_1: Mapped[str] = mapped_column(String(3))
    investment_amount_1: Mapped[float] = mapped_column(Numeric(5, 2))

    investment_coin_2: Mapped[str] = mapped_column(String(32))
    investment_currency_2: Mapped[str] = mapped_column(String(3))
    investment_amount_2: Mapped[float] = mapped_column(Numeric(5, 2))
```

Pursuing a Relationship

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class Portfolio(Base):
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class Investment(Base):
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    amount: Mapped[float] = mapped_column()
    portfolio_id: Mapped[int]
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    amount: Mapped[float] = mapped_column()
    portfolio_id: Mapped[int] = mapped_column(ForeignKey(“portfolio.id”))
    portfolio: Mapped[“Portfolio”] = relationship()
```

Pursuing a Relationship

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    investments: Mapped[List[“Investment”]] = relationship()

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    portfolio_id: Mapped[int] = mapped_column(ForeignKey(“portfolio.id”))
    portfolio: Mapped[“Portfolio”] = relationship(back_populates=“investments”)
```

Adding Portfolios

```
portfolio = Portfolio(name="My Portfolio", description="My Description")

bitcoin = Investment(coin="bitcoin", currency="USD", amount=1.0)
ethereum = Investment(coin="ethereum", currency="GBP", amount=10.0)
dogecoin = Investment(coin="dogecoin", currency="EUR", amount=100.0)
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Adding Portfolios

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bitcoin.portfolio = portfolio
```

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bitcoin.portfolio = portfolio

portfolio.investments.extend([ethereum, dogecoin])
```

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dogecoin = Investment(coin="dogecoin", currency="EUR", amount=100.0)

bitcoin.portfolio = portfolio

portfolio.investments.extend([ethereum, dogecoin])

with Session(engine) as session:
    session.add(portfolio)
    session.commit()
```

Summary

SQLAlchemy has two APIs

- ORM
- Core API

Object Relational Mapper

Model classes

- Configure mappings to the database

Relationships

- Access related objects

Core API

- Perform CRUD tasks
- Work with typed model classes

Swap out databases

Coming up next ... NoSQL!