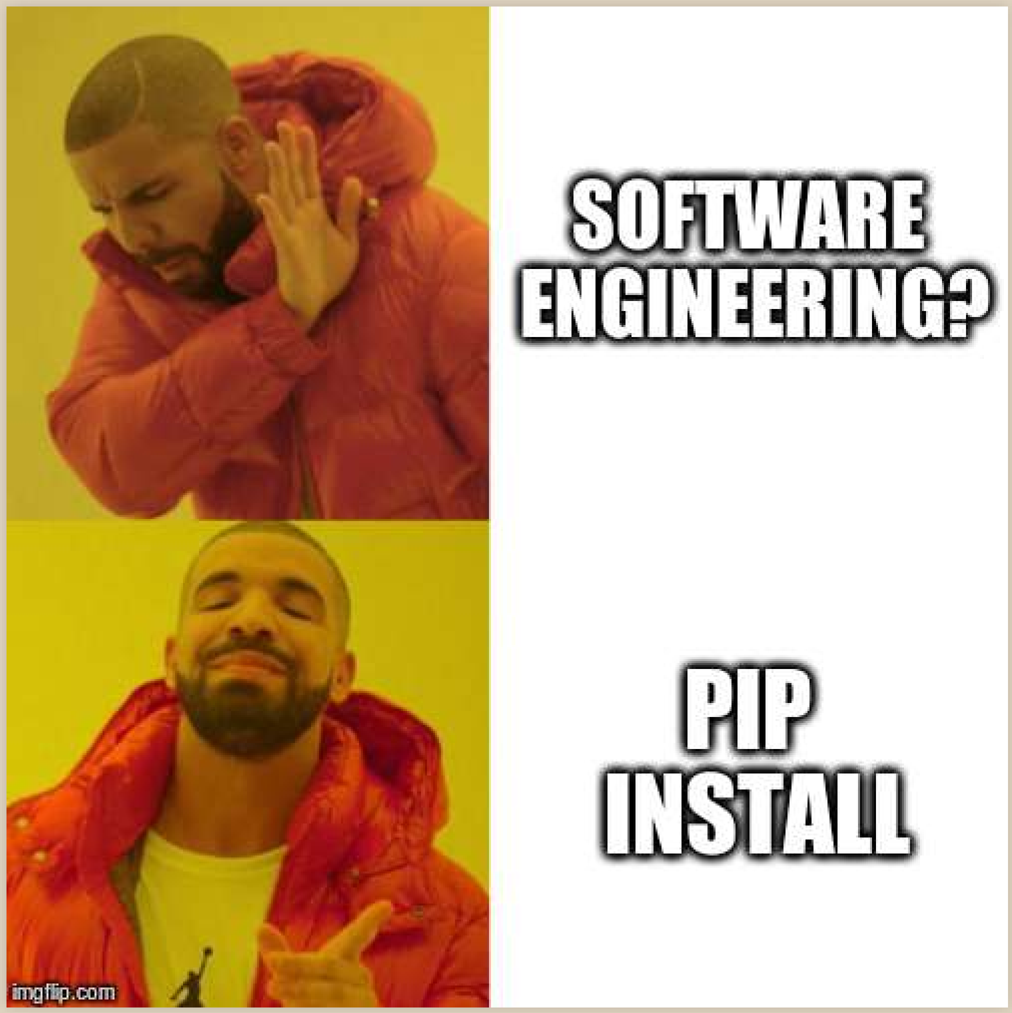
Clean Architecture

in Python

Sebastian Buczyński
@
PyKonik Tech Talks #36

STX NEXT
TAXI
Apteka
KOMPUTER


SOFTWARE ENGINEERING?
PIP INSTALL
imgflip.com

Clean Architecture

1. Independence of frameworks
2. Testability
3. Independence of UI
4. Independence of database

Clean Architecture

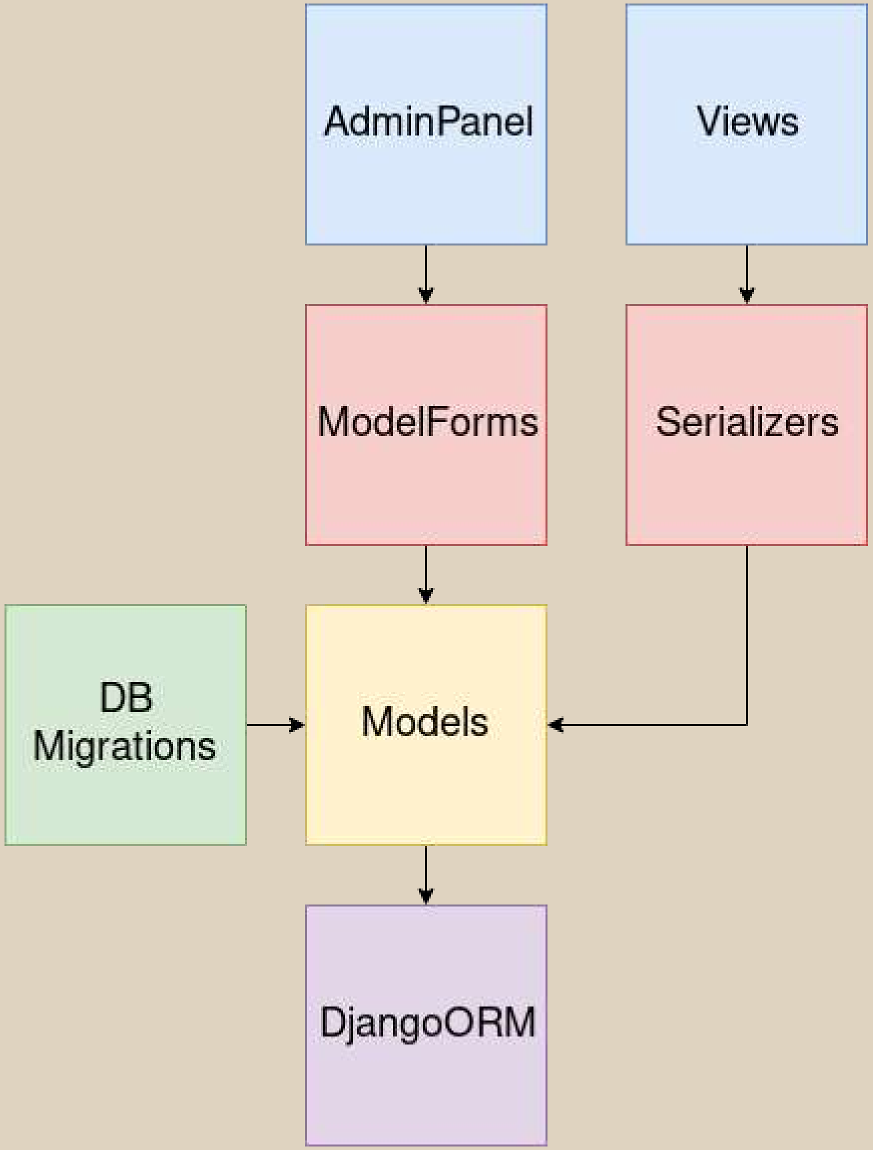
Putting customer's concerns in the first place

Project: Auctions online

User stories

- As a bidder I want to make a bid to win an auction
- As a bidder I want to be notified by e-mail when my offer is a winning one
- As an administrator I want to be able to withdraw a bid

Django + Rest Framework!


AdminPanel
Views
ModelForms
Serializers
DB Migrations
Models
DjangoORM

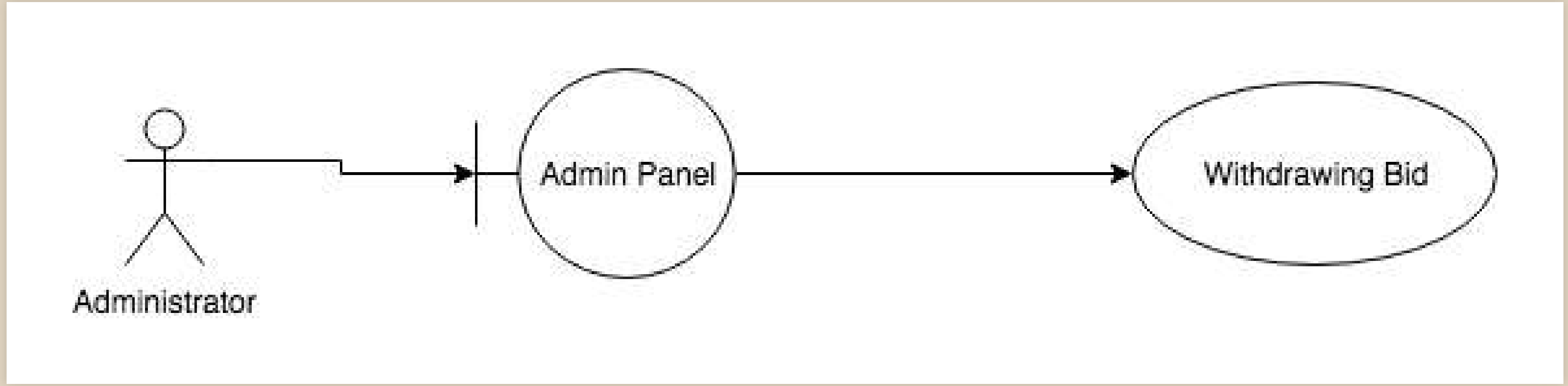
Models first

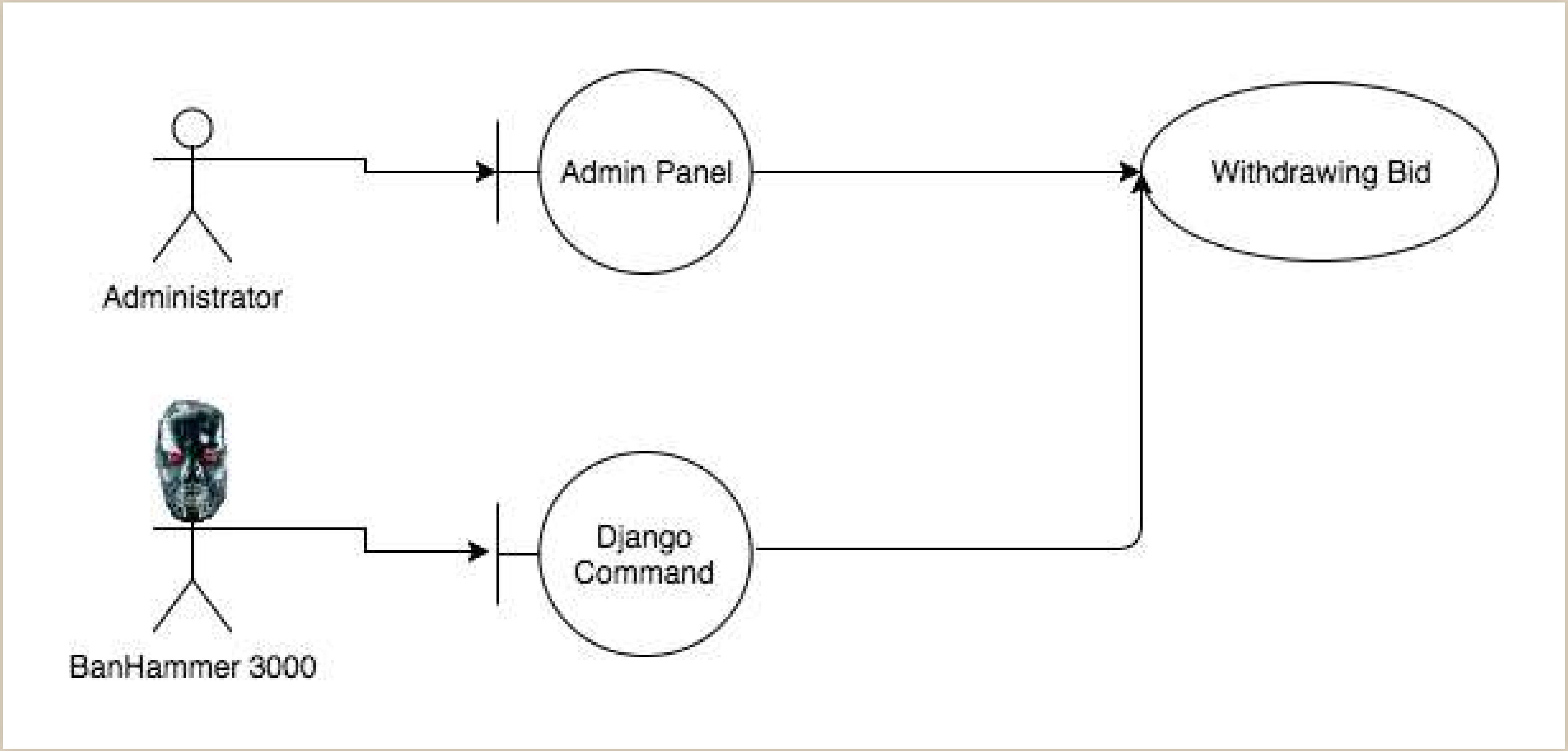
```
class Auction(models.Model):
    title = models.CharField(...)
    initial_price = models.DecimalField(...)
    current_price = models.DecimalField(...)


class Bid(models.Model):
    amount = models.DecimalField(...)
    bidder = models.ForeignKey(...)
    auction = models.ForeignKey(Auction, on_delete=PROTECT)
```

User stories

- ~~As a bidder I want to make a bid to win an auction~~ ✔
- ~~As a bidder I want to be notified by e-mail when my offer is a winning one~~ ✔
- As an administrator I want to be able to withdraw a bid

```
def save_related(self, request, form, formsets, *args, **kwargs):
    ids_of_deleted_bids = self._get_ids_of_deleted_bids(formsets)
    bids_to_withdraw = Bid.objects.filter(
        pk__in=ids_of_deleted_bids)

    auction = form.instance
    old_winners = set(auction.winners)
    auction.withdraw_bids(bids_to_withdraw)
    new_winners = set(auction.winners)

    self._notify_winners(new_winners - old_winners)

    super().save_related(request, _form, formsets, *args, **kwarg
def save_related(self, request, form, formsets, *args, **kwargs):
    ids_of_deleted_bids = self._get_ids_of_deleted_bids(formsets)
    bids_to_withdraw = Bid.objects.filter(
        pk__in=ids_of_deleted_bids)

    auction = form.instance
    old_winners = set(auction.winners)
    auction.withdraw_bids(bids_to_withdraw)
    new_winners = set(auction.winners)

    self._notify_winners(new_winners - old_winners)

    super().save_related(request, _form, formsets, *args, **kwarg
def save_related(self, request, form, formsets, *args, **kwargs):
    ids_of_deleted_bids = self._get_ids_of_deleted_bids(formsets)
    bids_to_withdraw = Bid.objects.filter(
        pk__in=ids_of_deleted_bids)

    auction = form.instance
    old_winners = set(auction.winners)
    auction.withdraw_bids(bids_to_withdraw)
    new_winners = set(auction.winners)

    self._notify_winners(new_winners - old_winners)

    super().save_related(request, _form, formsets, *args, **kwarg
```


Administrator
Admin Panel
Withdrawing Bid


Admin Panel
Withdrawing Bid
Administrator
Django Command
BanHammer 3000

Clean Arch - building block #1

```
class WithdrawingBid:
    def withdraw_bids(self, auction_id, bids_ids):
        auction = Auction.objects.get(pk=auction_id)
        bids_to_withdraw = Bid.objects.filter(
            pk__in=ids_of_deleted_bids)

        old_winners = set(auction.winners)
        auction.withdraw_bids(bids_to_withdraw)
        new_winners = set(auction.winners)

        self._notify_winners(new_winners - old_winners)
```

UseCase OR Interactor

UseCase - Orchestrates a particular process

What about tests?!

Business logic is coupled with a framework, so are tests...

Testing through views

```
from django.test import TestCase

class LoginTestCase(TestCase):

    def test_login(self):
        User.objects.create(...)

        response = self.client.get('/dashboard/')

        self.assertRedirects(response, '/accounts/login/')
```

How a textbook example looks like?

```
class MyTest(unittest.TestCase):
    def test_add(self):
        expected = 7

        actual = add(3, 4)

        self.assertEqual(actual, expected)
```

No side effects and dependencies makes code easier to test

Getting rid of dependencies: find them

```
class WithdrawingBidUseCase:
    def withdraw_bids(self, auction_id, bids_ids):
        auction = Auction.objects.get(pk=auction_id)
        bids_to_withdraw = Bid.objects.filter(
            pk__in=ids_of_deleted_bids)

        old_winners = set(auction.winners)
        auction.withdraw_bids(bids_to_withdraw)
        new_winners = set(auction.winners)

        self._notify_winners(new_winners - old_winners)
```

Getting rid of dependencies: hide them

```
class WithdrawingBidUseCase:
    def withdraw_bids(self, auction_id, bids_ids):
        auction = self.auctions_repository.get(auction_id)
        bids = self.bids_repository.get_by_ids(bids_ids)

        old_winners = set(auction.winners)
        auction.withdraw_bids(bids)
        new_winners = set(auction.winners)

        self.auctions_repository.save(auction)
        for bid in bids:
            self.bids_repository.save(bid)

        self._notify_winners(new_winners - old_winners)
```

Getting rid of dependencies: hide them

```
class WithdrawingBidUseCase:
    def withdraw_bids(self, auction_id, bids_ids):
        auction = self.auctions_repository.get(auction_id)
        bids = self.bids_repository.get_by_ids(bids_ids)

        old_winners = set(auction.winners)
        auction.withdraw_bids(bids)
        new_winners = set(auction.winners)

        self.auctions_repository.save(auction)
        for bid in bids:
            self.bids_repository.save(bid)

        self._notify_winners(new_winners - old_winners)
```

Clean Arch - building block #2

```python
class AuctionsRepo(metaclass=ABCMeta):

    @abstractmethod
    def get(self, auction_id):
        pass

    @abstractmethod
    def save(self, auction):
        pass
```

Interface / Port

Clean Arch - building block #3

```python
class DjangoAuctionsRepo(AuctionsRepo):

    def get(self, auction_id):
        return Auction.objects.get(pk=auction_id)
```

Interface Adapter / Port Adapter

Combine together

```
class WithdrawingBidUseCase:
    def __init__(self, auctions_repository: AuctionsRepo):
        self.auctions_repository = auctions_repository
```

```
django_adapter = DjangoAuctionsRepo()
withdrawing_bid_uc = WithdrawingBidUseCase(django_adapter)
```

Dependency Injection

```python
import inject

def configure_inject(binder: inject.Binder):
    binder.bind(AuctionsRepo, DjangoAuctionsRepo())

inject.configure_once(configure_inject)
```

```python
class WithdrawingBidUseCase:

    auctions_repo: AuctionsRepo = inject.attr(AuctionsRepo)
```

Benefits from another layer

- It is easier to reason about logic
- It is possible to write TRUE unit tests
- Work can be parallelized
- **Decision making can be delayed**

Our logic is still coupled to a database!

```
class WithdrawingBidUseCase:
    def withdraw_bids(self, auction_id, bids_ids):
        auction = self.auctions_repository.get(auction_id)
        bids = self.bids_repository.get_by_ids(bids_ids)

        old_winners = set(auction.winners)
        auction.withdraw_bids(bids)
        new_winners = set(auction.winners)

        self.auctions_repository.save(auction)
        for bid in bids:
            self.bids_repository.save(bid)

        self._notify_winners(new_winners - old_winners)
```

Clean Arch - building block #0

```
class Auction:
    def __init__(self, id: int, title: str, bids: List[Bid]):
        self.id = id
        self.title = title
        self.bids = bids

    def withdraw_bids(self, bids: List[Bid]):
        ...

    def make_a_bid(self, bid: Bid):
        ...

    @property
    def winners(self):
        ...
```

Entity

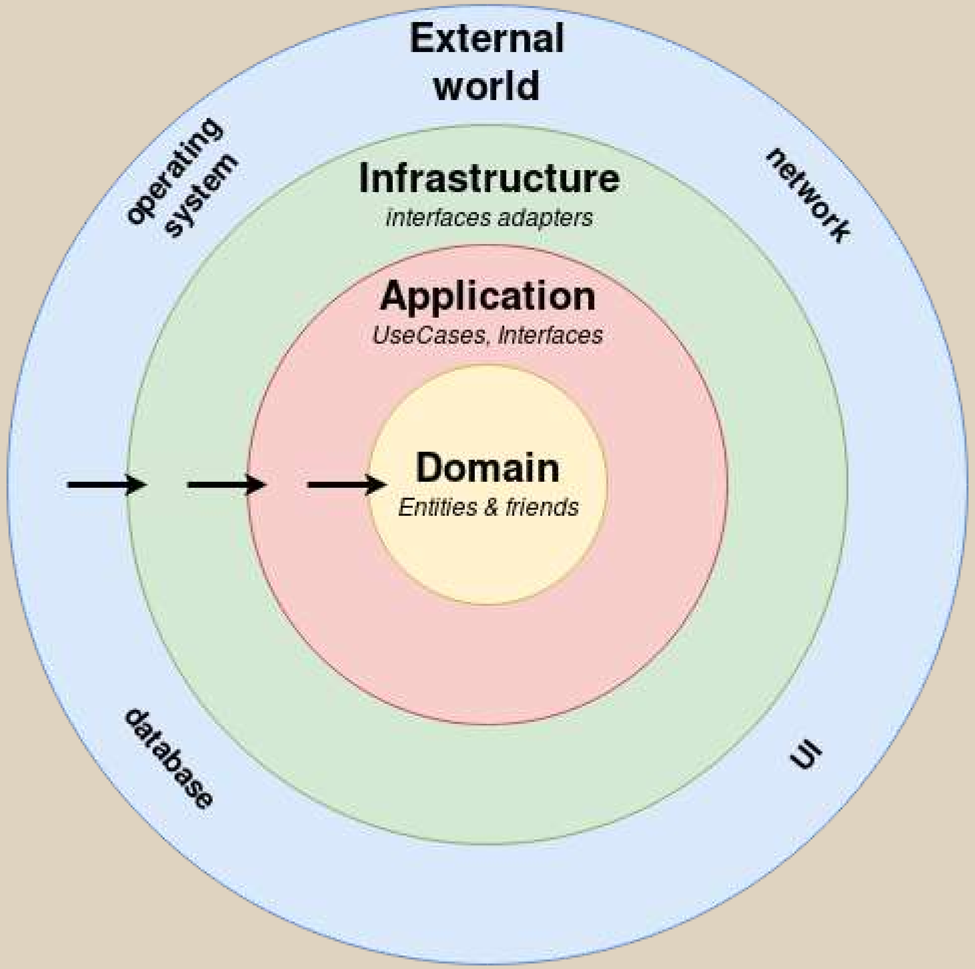
Clean Arch - building block #3

```python
class DjangoAuctionsRepo(AuctionsRepo):
    def get(self, auction_id: int) -> Auction:
        auction_model = AuctionModel.objects.prefetch_related(
            'bids'
        ).get(pk=auction_id)

        bids = [
            self._bid_from_model(bid_model)
            for bid_model in auction_model.bids.all()
        ]

        return Auction(
            auction_model.id,
            auction_model.title,
            bids
        )
```

Interface Adapter / Port Adapter

All that's left is to call UseCase from ~~Django~~ any framework

Clean Arch building blocks altogether



What to be careful of?

- non-idiomatic framework use
- more code (type hints help)
- copying data between objects
- validation?
- overengineering

When it pays off?

- lots of cases - testability
- delaying decision making - stay lean
- complicated domain

That's all, folks!

Questions?

Futher reading

https://8thlight.com/blog/uncle-bob/2012/08/13/the-clean-architecture.html

Clean Architecture: A Craftsman's Guide to Software Structure and Design

Clean Architecture Python (web) apps - Przemek Lewandowski

Software architecture chronicles - blog posts series

Boundaries - Gary Bernhardt

Exemplary project in PHP (blog post)

Exemplary project in PHP (repo)

Exemplary project in C# (repo)

Exemplary project in Python (repo)