OOP: Object Oriented Programming

Vocabulary

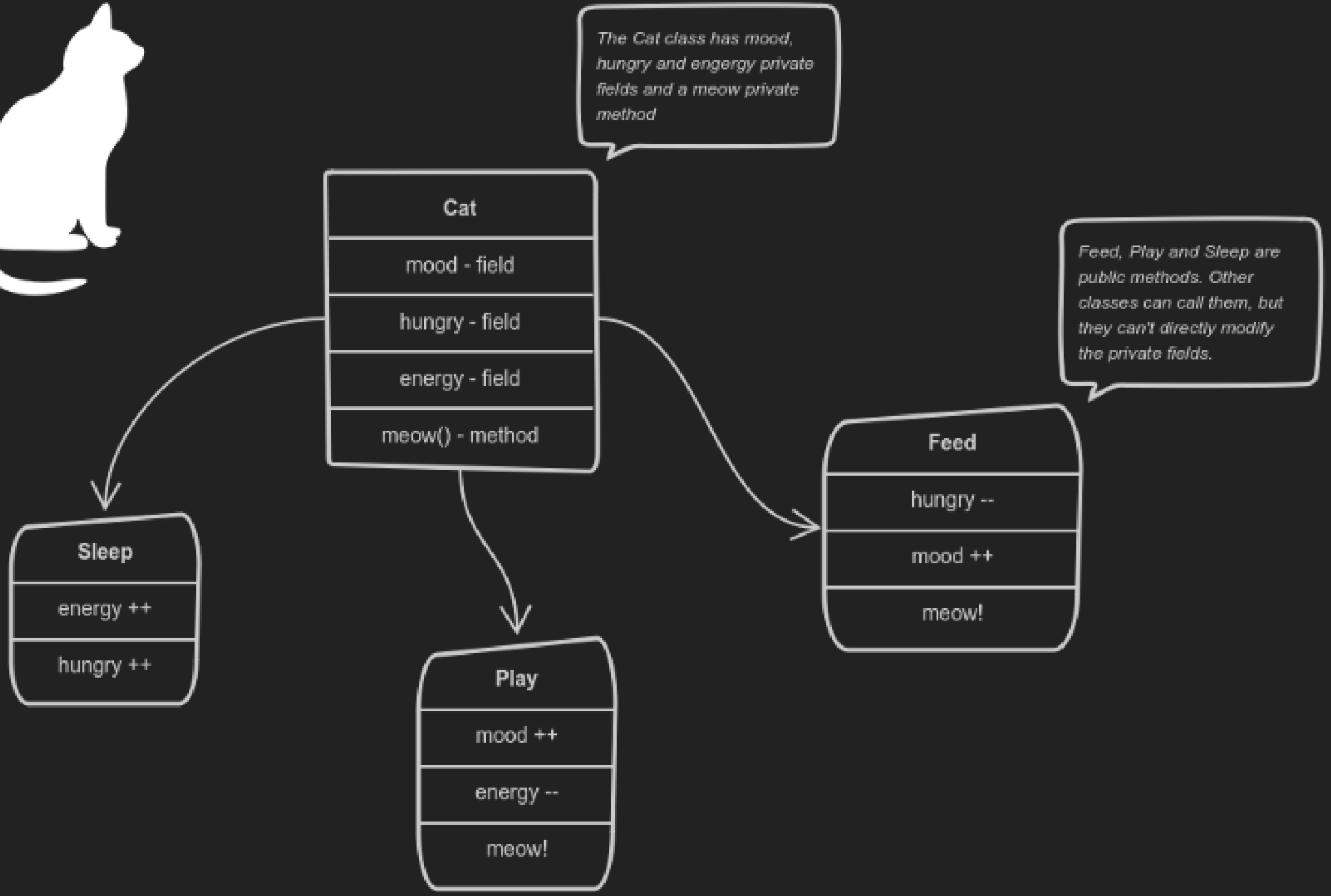
- Type, Primitive, Class, Instance, Generics
- Variable, Function, Property, Method
- Inherit, Override, Implement, Abstract

Principles

- Encapsulation
- Abstraction
- Inheritance
- Polymorphism

Encapsulation

Hide the internal state


The Cat class has mood, hungry and engergy private fields and a meow private method
Cat
mood - field
hungry - field
energy - field
meow() - method
Feed, Play and Sleep are public methods. Other classes can call them, but they can't directly modify the private fields.
Sleep
energy ++
hungry ++
Play
mood ++
energy --
meow!
Feed
hungry --
mood ++
meow!

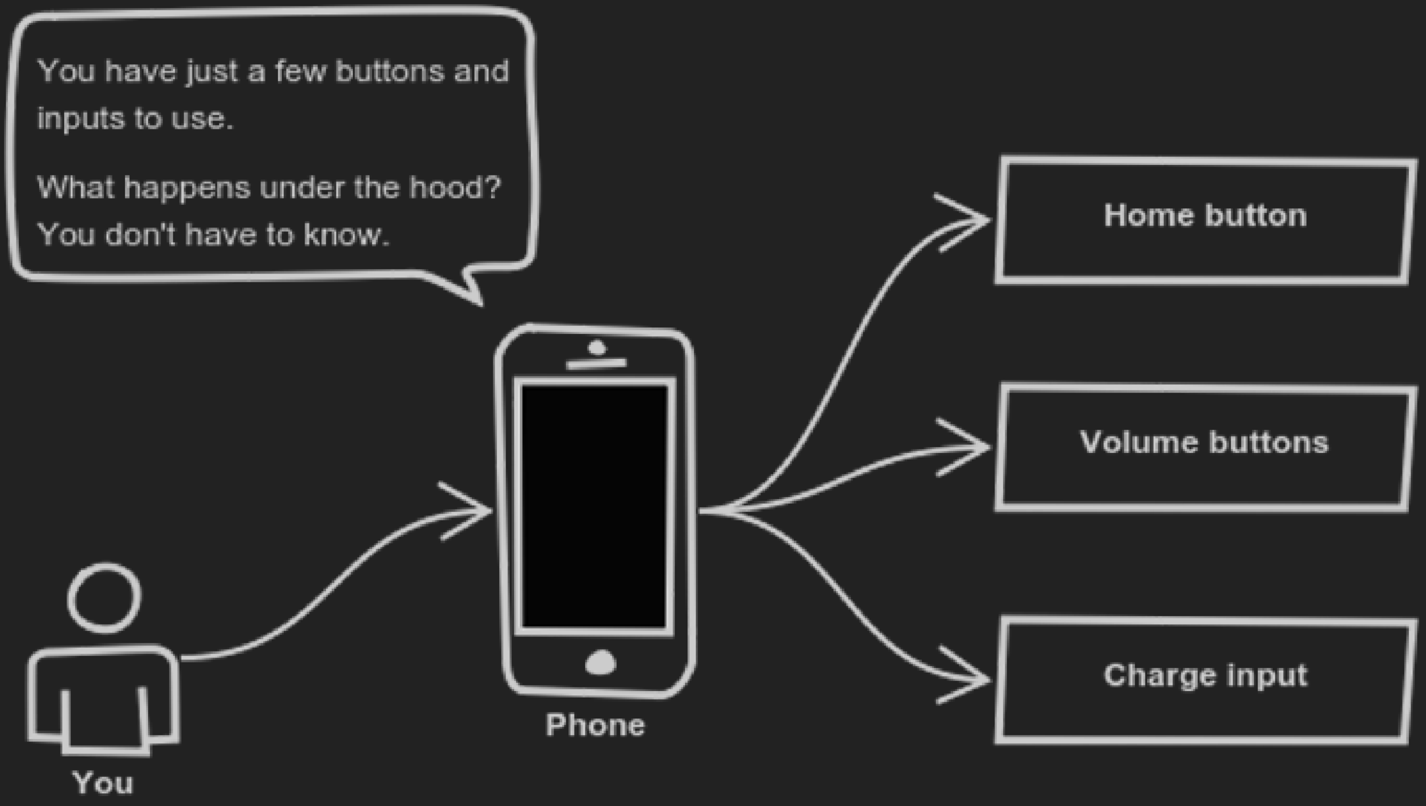
Encapsulation: Example

```
class Cat {
    private var lives = 9

    public fun die() {
        if (lives > 0) lives--
        else print("Meowargh 💀")
    }
}
```

Abstraction

Expose high level handles


You have just a few buttons and inputs to use.
What happens under the hood? You don't have to know.
You
Phone
Home button
Volume buttons
Charge input

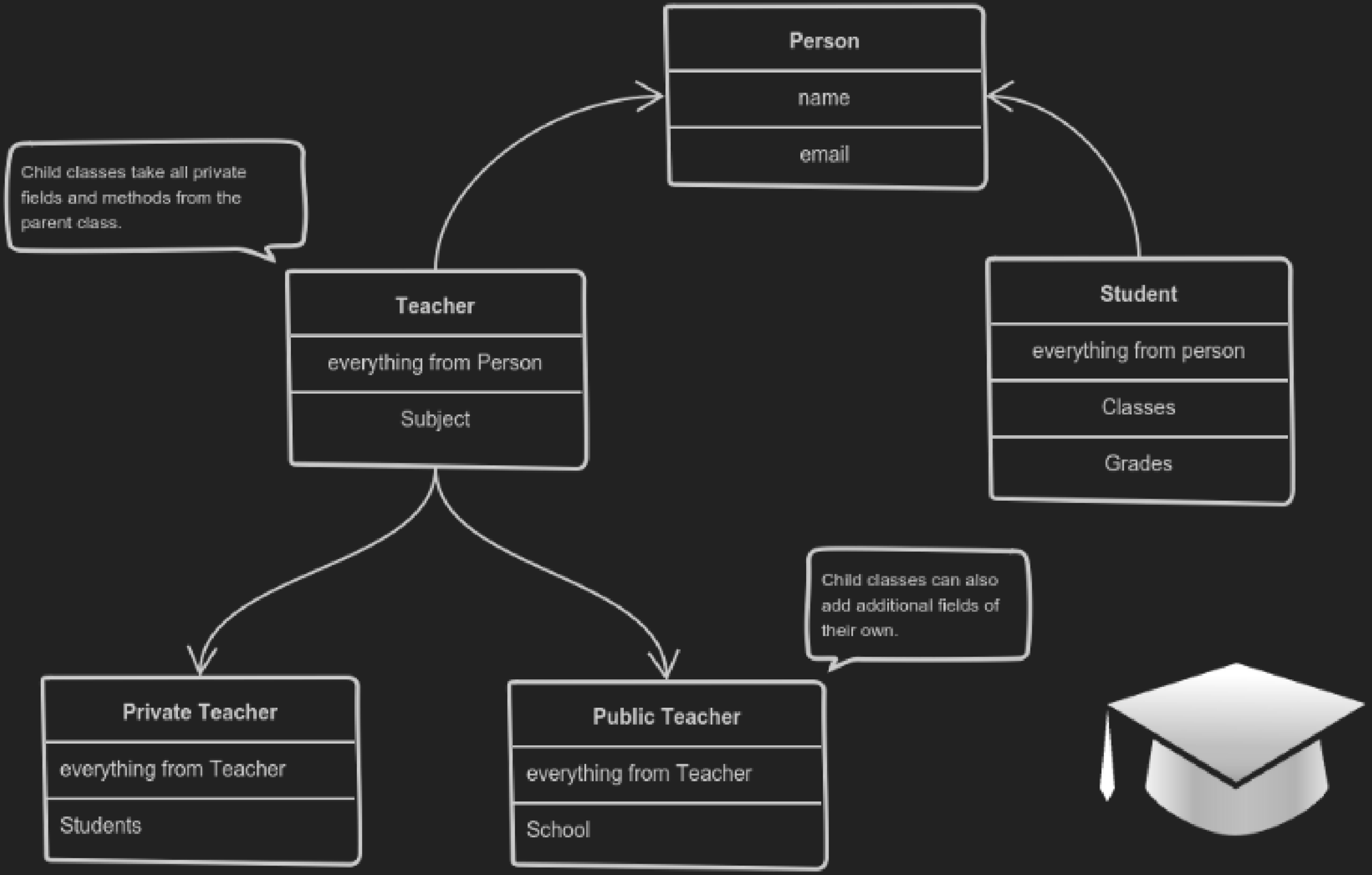
Abstraction Example

```
class CoffeeMachine {
    private var isWaterHot = false
    private fun makeEspresso() { ... }
    private fun makeLatte() { ... }
    //...

    public fun makeCoffee(coffeeType: CoffeeType) {
        when(coffeeType) {
            Espresso -> makeEspresso()
            Latte -> makeLatte()
            //...
        }
    }
}
```

Inheritance

Extend an other Class



Inheritance Example

```
class Animal {
    fun eat() {
        print("nom nom")
    }
}

class Cat : Animal {
    var isBored = false
    override fun eat() {
        if (isBored) {
            super.eat()
        }
    }
}
```

Interface

```kotlin
interface FriendsDataSource {
    val url: String
    fun getFriends() : List<Friend>
}

class TwitterFriendsDataSource : FriendsDataSource {
    override val url = "https://twitter.com/friends"
    override fun getFriends() : List<Friend> {
        // request from Twitter
    }
}

class FacebookFriendsDataSource : FriendsDataSource {
    override val url = "https://facebook.com/friends"
    override fun getFriends() : List<Friend> {
        // request from Facebook
    }
}
```

Abstract class

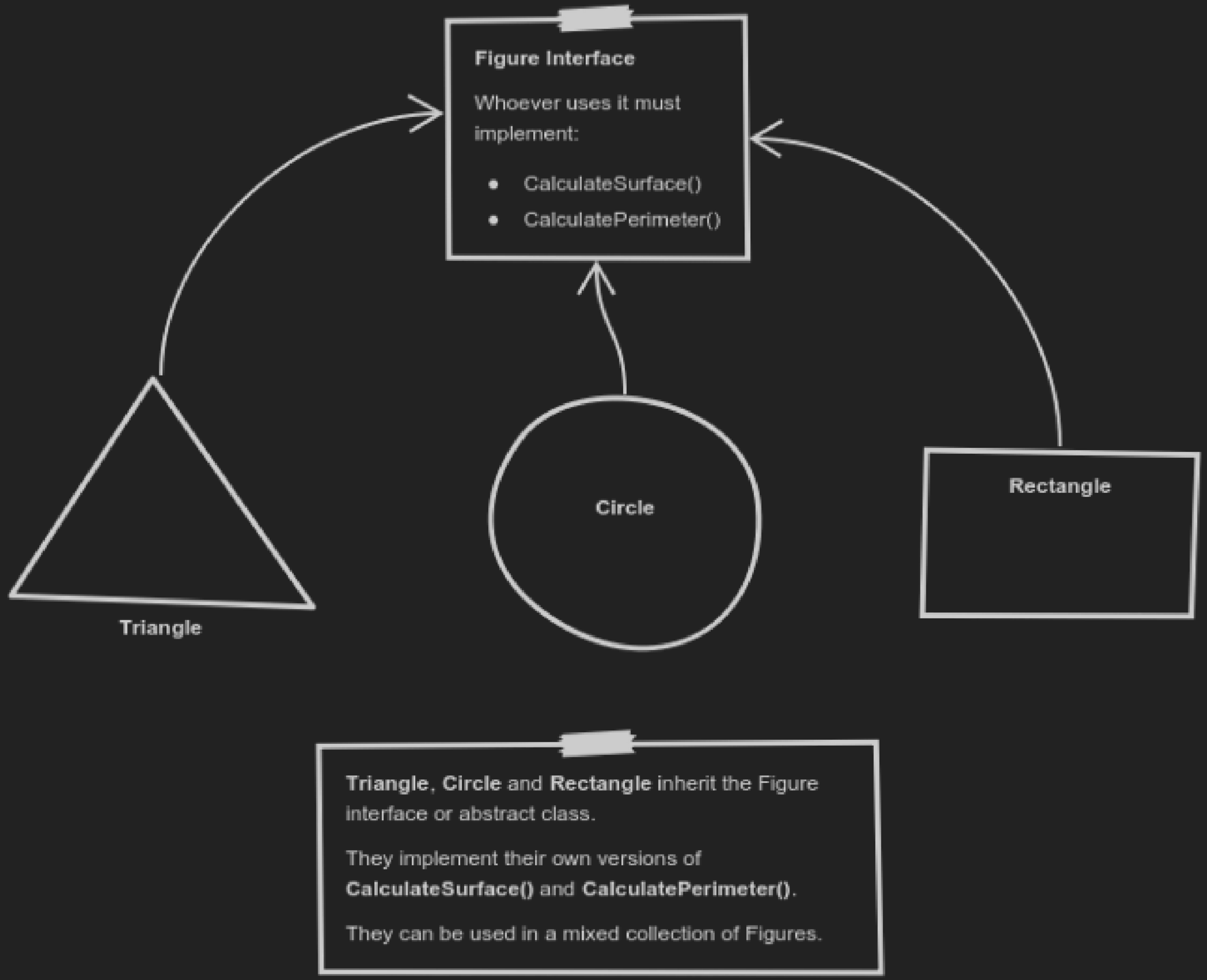
```
abstract class FriendsDataSource {
    val url: String
    fun getFriends() : List<Friend> {
        return emptyList()
    }
}

class TwitterFriendsDataSource : FriendsDataSource {
    override val url = "https://twitter.com/friends"
    override fun getFriends() : List<Friend> {
        // request from Twitter
    }
}

class FacebookFriendsDataSource : FriendsDataSource {
    override val url = "https://facebook.com/friends"
    override fun getFriends() : List<Friend> {
        // request from Facebook
    }
}
```

Polymorphism

Use the same code for different types



Triangle, **Circle** and **Rectangle** inherit the Figure interface or abstract class.

They implement their own versions of **CalculateSurface()** and **CalculatePerimeter()**.

They can be used in a mixed collection of Figures.

Polymorphism example

```
fun calculateTotalSurface(figures: List<Figure>) : Int {
    var totalSurface = 0
    figures.forEach { figure ->
        totalSurface += figure.calculateSurface()
    }
    return totalSurface
}
```

SOLID principles

- Single-responsibility: A class should have a single responsibility
- Open–closed: open for extension, closed for modification
- Liskov substitution: No changes when replacing objects by their subtypes
- Interface segregation: Prefer several specific interfaces to a general one
- Dependency inversion: Depend upon abstractions, not concretions

Other Principles

- DRY: Don't Repeat Yourself
- YAGNI: You Are Not Gonna Need It
- KISS: Keep it simple, stupid
- SSOT: Single source of truth

Going Further

- Design Patterns (Singleton, Factory, ...)
- Dependency Injection
- Is Inheritance bad ?
- Often prefer composition: "has-a" VS "is-a"
- Entity Component System
- OOP is not a silver bullet

Other Paradigms

- Procedural Programming
- Functional Programming
- Data Oriented Design
- Reactive Programming

Links

- How to explain object-oriented programming concepts to a 6-year-old
- OOP
- SOLID
- Uncle Bob's blog
- Brian Will's site (OOP critics, Game Development, Programming lessons)