Backticks & Tildes

The S.O.L.I.D Principles in Pictures

Ugonna Thelma Follow

5 min read · May 18, 2020

45K 211

***All illustrations in this article are by Ugonna Thelma**

If you are familiar with Object-Oriented Programming, then you've probably heard about the SOLID principles.

These five software development principles are guidelines to follow when building software so that it is easier to scale and maintain. They were made popular by a software engineer, Robert C. Martin.

There are so many great articles online about **SOLID** but I rarely see any examples with pictures. This makes it a bit difficult for visual learners like me to learn while staying engaged.

So the main aim of this article is to get a better understanding of these principles using illustrations and emphasizing the goal for each principle.

You see, some of these principles may look similar but they are not targeting **the same goal**. It is possible to satisfy one principle while violating the other, even though they are alike.

To make this as simple to follow, I will be using the word "**Class**" but note that it can also apply to a **Function**, **Method** or **Module** in this article.

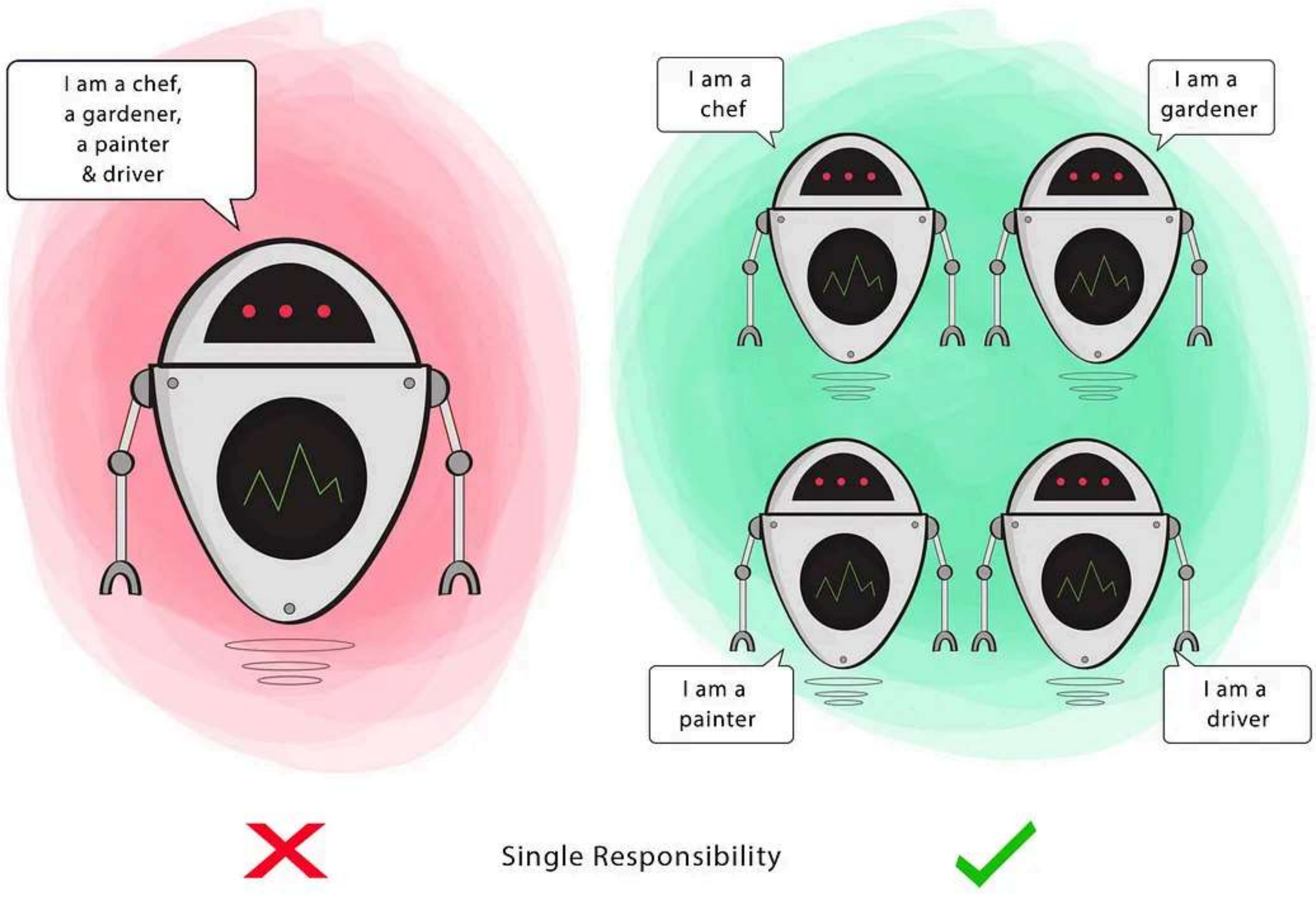
> ***Update****
> *I got some comments about the Open Closed in this article violating the Single Responsibility Principle. Please note that the aim of this article is to explain each of these principles independent of the others.*
>
> *Also, Responsibilities(or Roles) are different from Actions. In SRP, I used "I am Painter", in Open-Closed, I used "I can Paint".*
>
> *It is important to note this because several actions can be performed to fulfil a responsibility(or role). The class should have one responsibility(SRP) but its functionality that fulfils that responsibility should be open to extend(OCP).*

Now, let's begin!

The SOLID Principles

S — Single Responsibility

A class should have a single responsibility



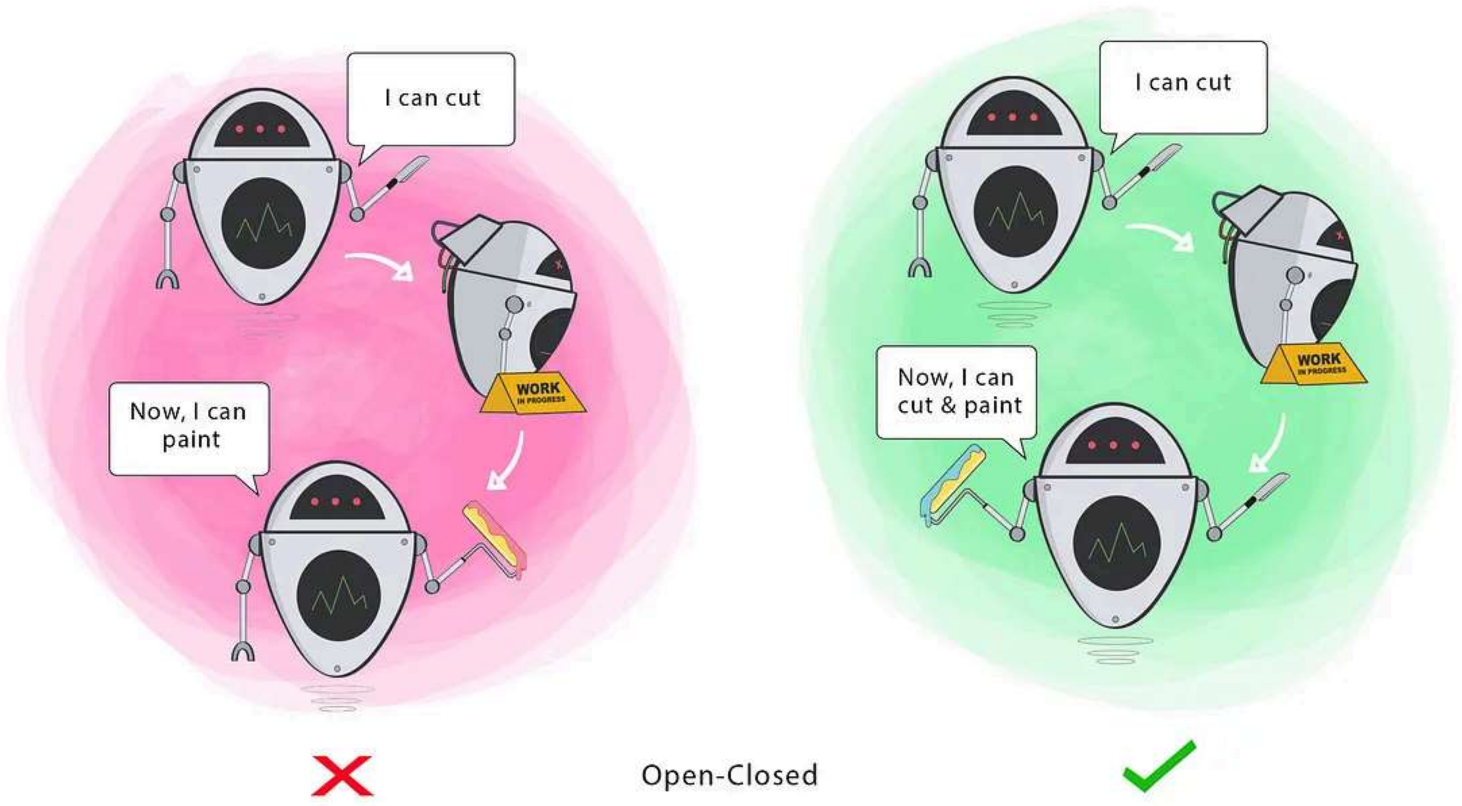
If a Class has many responsibilities, it increases the possibility of bugs because making changes to one of its responsibilities, could affect the other ones without you knowing.

Goal

This principle aims to separate behaviours so that if bugs arise as a result of your change, it won't affect other unrelated behaviours.

O — Open-Closed

> Classes should be open for extension, but closed for modification



Changing the current behaviour of a Class will affect all the systems using that Class.

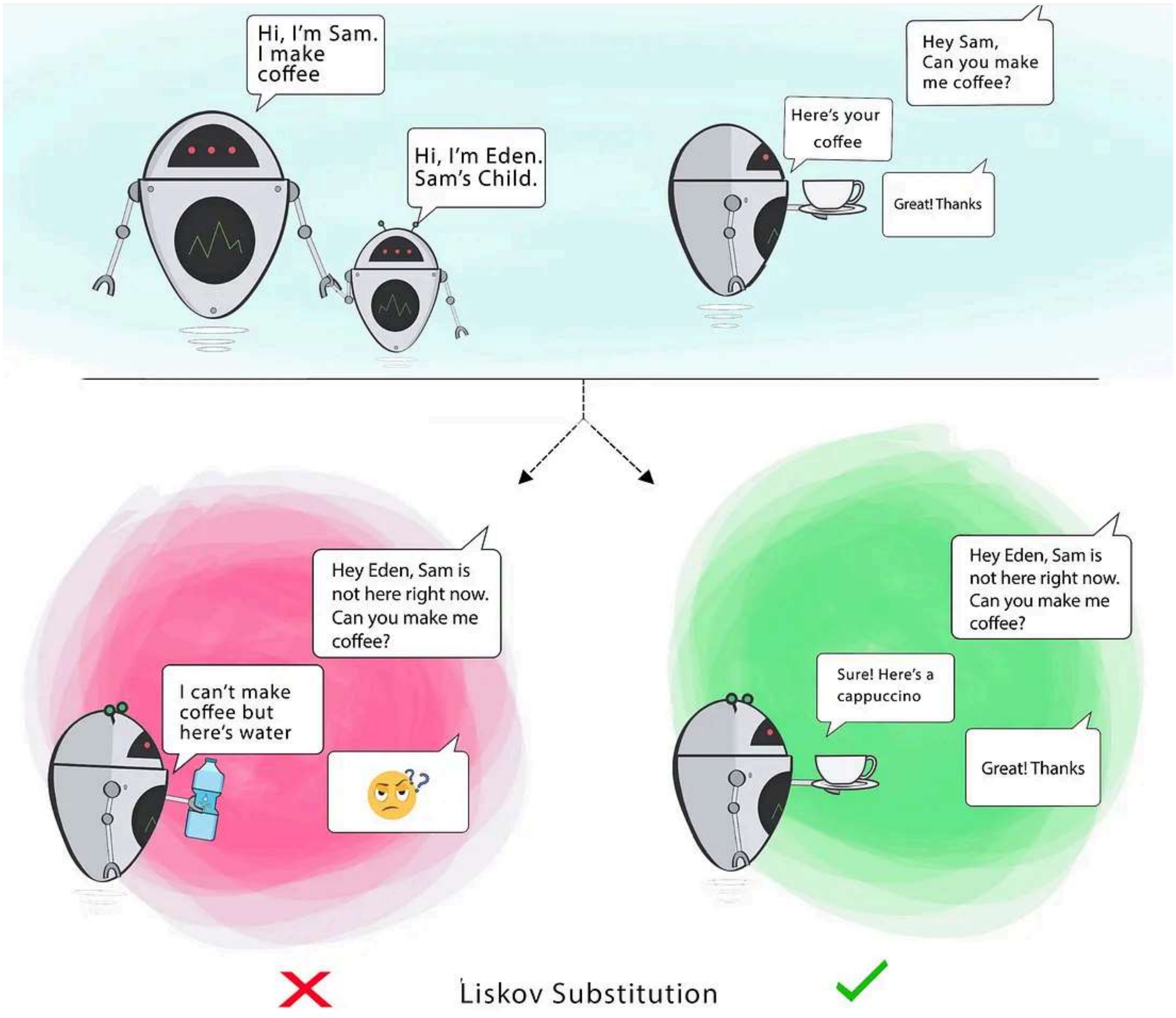
If you want the Class to perform more functions, the ideal approach is to add to the functions that already exist NOT change them.

Goal

This principle aims to extend a Class's behaviour without changing the existing behaviour of that Class. This is to avoid causing bugs wherever the Class is being used.

L — Liskov Substitution

> If S is a subtype of T, then objects of type T in a program may be replaced with objects of type S without altering any of the desirable properties of that program.


Hi, I'm Sam. I make coffee
Hi, I'm Eden. Sam's Child.
Hey Sam, Can you make me coffee?
Here's your coffee
Great! Thanks
Hey Eden, Sam is not here right now. Can you make me coffee?
I can't make coffee but here's water
Hey Eden, Sam is not here right now. Can you make me coffee?
Sure! Here's a cappuccino
Great! Thanks
Liskov Substitution

When a **child** Class cannot perform the same actions as its **parent** Class, this can cause bugs.

If you have a Class and create another Class from it, it becomes a **parent** and the new Class becomes a **child.** The **child** Class should be able to do everything the **parent** Class can do. This process is called **Inheritance.**

The **child** Class should be able to process the same requests and deliver the same result as the **parent** Class or it could deliver a result that is of the same type.

The picture shows that the **parent** Class delivers Coffee(it could be any type of coffee). It is acceptable for the **child** Class to deliver Cappucino because it is a specific type of Coffee, but it is NOT acceptable to deliver Water.

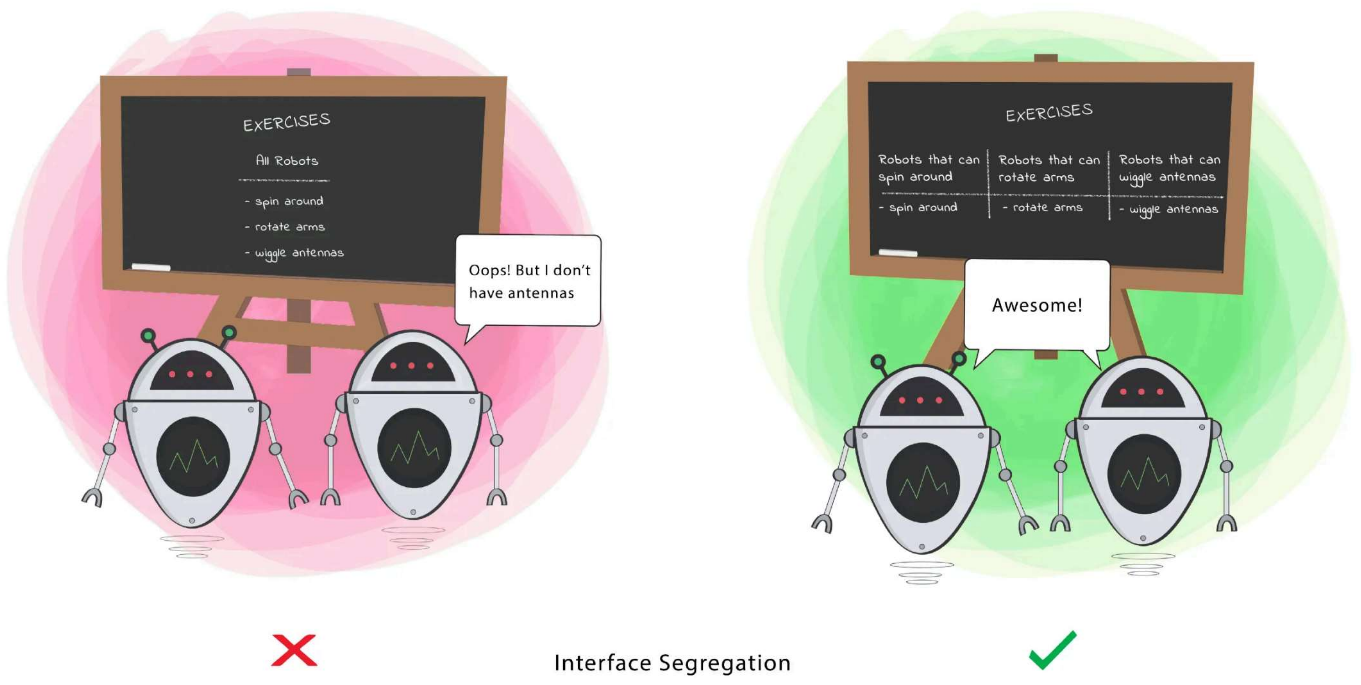
If the **child** Class doesn't meet these requirements, it means the **child** Class is changed completely and violates this principle.

Goal

This principle aims to enforce consistency so that the parent Class or its child Class can be used in the same way without any errors.

I — Interface Segregation

> Clients should not be forced to depend on methods that they do not use.



When a Class is required to perform actions that are not useful, it is wasteful and may produce unexpected bugs if the Class does not have the ability to perform those actions.

A Class should perform only actions that are needed to fulfil its role. Any other action should be removed completely or moved somewhere else if it might be used by another Class in the future.

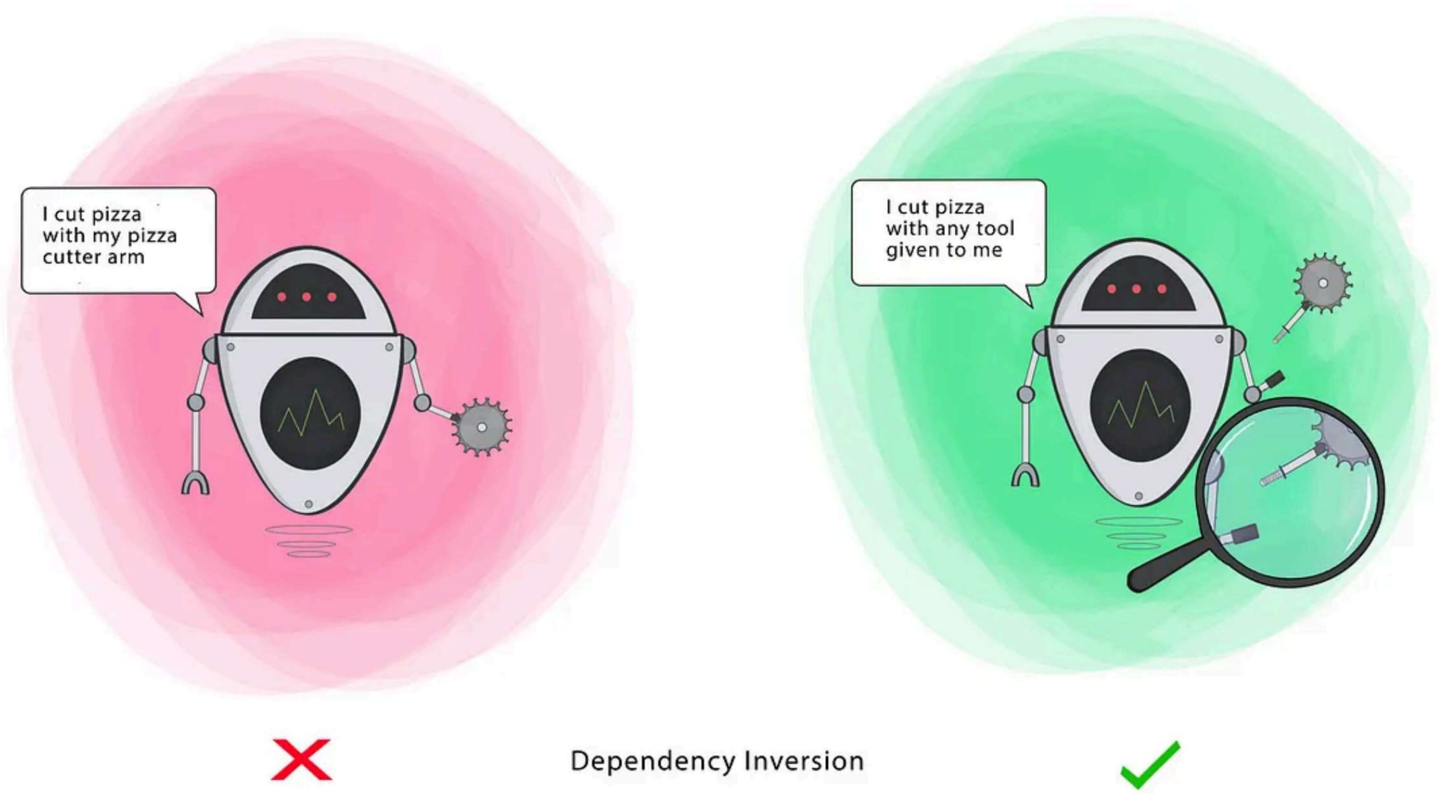
Goal

This principle aims at splitting a set of actions into smaller sets so that a Class executes ONLY the set of actions it requires.

D — Dependency Inversion

- High-level modules should not depend on low-level modules. Both should depend on the abstraction.

- Abstractions should not depend on details. Details should depend on abstractions.


I cut pizza with my pizza cutter arm
I cut pizza with any tool given to me
Dependency Inversion

Firstly, let's define the terms used here more simply

High-level Module(or Class): Class that executes an action with a tool.

Low-level Module (or Class): The tool that is needed to execute the action

Abstraction: Represents an interface that connects the two Classes.

Details: How the tool works

This principle says a Class should not be fused with the tool it uses to execute an action. Rather, it should be fused to the interface that will allow the tool to connect to the Class.

It also says that both the Class and the interface should not know how the tool works. However, the tool needs to meet the specification of the interface.

Goal

This principle aims at reducing the dependency of a high-level Class on the low-level Class by introducing an interface.

Summary

So far, we have discussed these five principles and highlighted their goals. They are to help you make your code easy to adjust, extend and test with little to no problems.

Thank you so much for reading. I hope you have a better idea about this topic and you had as much fun reading this as I did writing it.

If you have any questions or suggestions, leave a comment.

For those interested in using the illustrations for print or professional purposes, kindly consider donating to the artist. By doing so, you'll gain access to high-resolution downloads via this link: https://payhip.com/b/Hvh57

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Written by Ugonna Thelma

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Software Engineer, UI Designer, Logo Designer, Childrens book illustrator :)

Responses (211)

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What are your thoughts?

Korede
May 18, 2020

This is one of the best written articles with visuals I've seen on SOLID Principles great job.

327 3 replies Reply

Alonso Del Arte
Jul 14, 2020

> I got some comments about the Open Closed in this article violating the Single Responsibility Principle. Please note that the aim of this article is to explain each of these principles ...

Even so, speaking only for myself, I find this inconsistency very confusing and contradictory, which defeats the point of putting this into pictures.

Maybe a better example would be: "I can cut in straight lines — Now I can cut in straight lines and... more

79 1 reply Reply

Vitalii Popov
May 22, 2020

Thank you for this great article, but I would suggest to change `O — Open-Closed` description. Because this principle says more about using composition instead of class inheritance. We... 68

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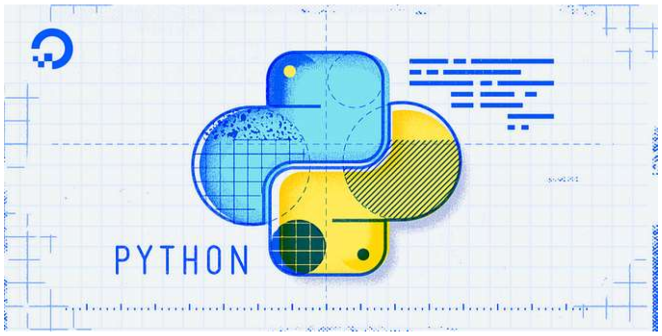

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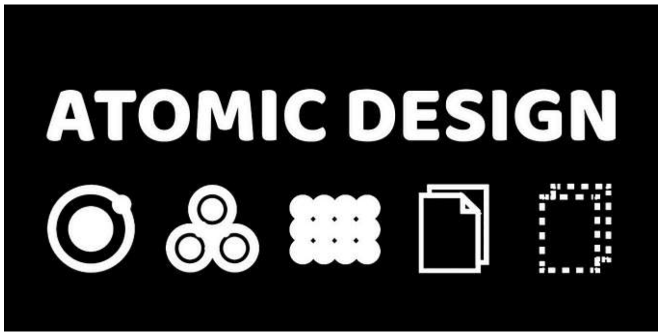

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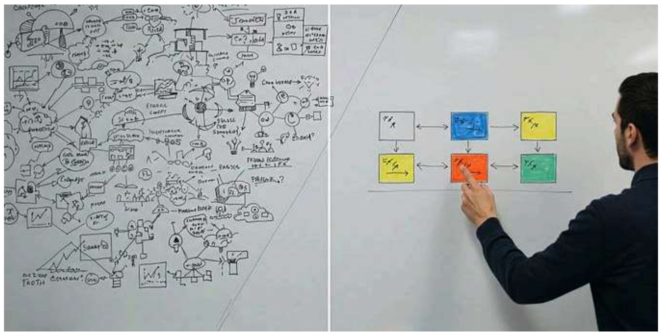

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