

# Dependency Inversion Principle

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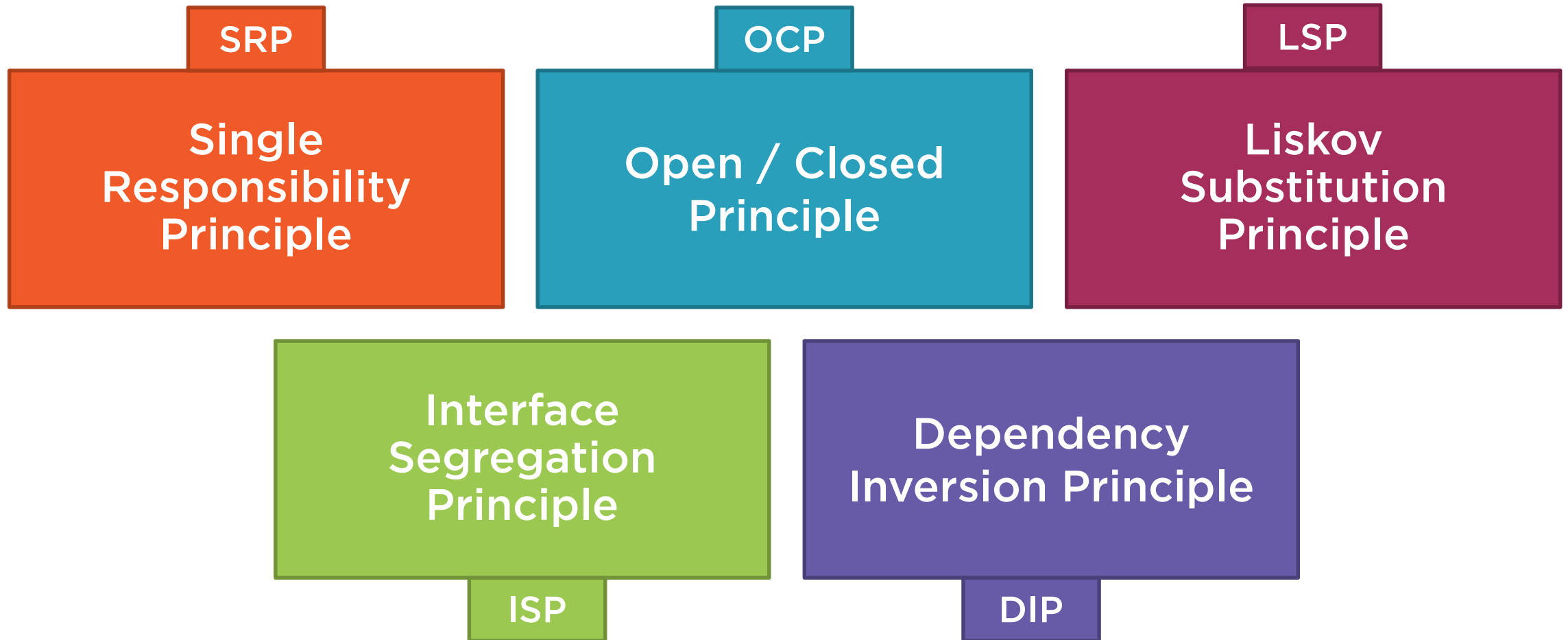
**Steve Smith**

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# SOLID Principles



# Dependency Inversion Principle

High-level modules should not **depend** on low-level modules. Both should **depend** on **abstractions**.

**Abstractions** should not **depend** on **details**.

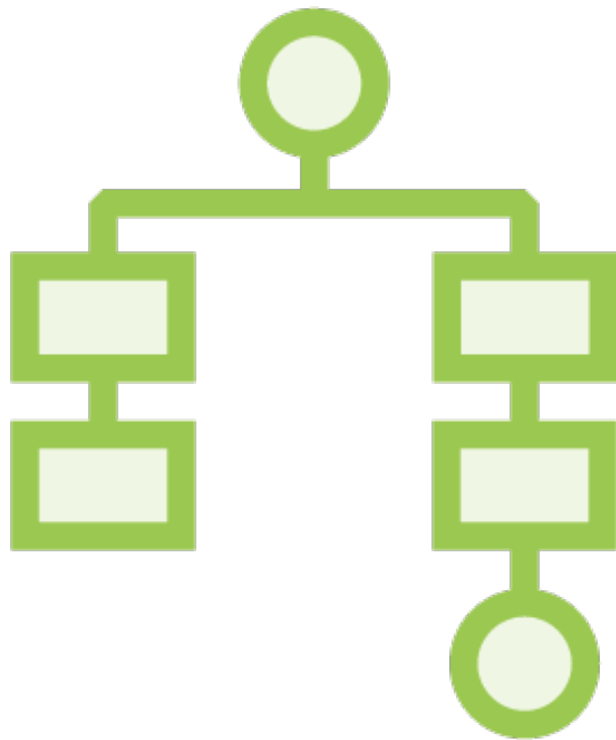
**Details** should **depend** on **abstractions**.



How do I know if something depends on something else?



# Dependencies in C#



References required to compile

References required to run

# Learn More



## **Microsoft Reference Application + eBook**

- [github.com/dotnet-architecture/eShopOnWeb](https://github.com/dotnet-architecture/eShopOnWeb)

## **Clean Architecture Solution Template**

- [github.com/ardalis/CleanArchitecture](https://github.com/ardalis/CleanArchitecture)

## **On Pluralsight**

- “Creating N-Tier Applications in C#”
- “Domain-Driven Design Fundamentals”



What's the difference  
between “high-level” and  
“low-level”?



# High Level



**More abstract**

**Business rules**

**Process-oriented**

**Further from input/output (I/O)**



# Low Level



Closer to I/O

“Plumbing” code

Interacts with specific external systems  
and hardware



## Separation of Concerns

Keep plumbing code  
separate from high  
level business logic



# What's an abstraction?

(in C#, in this context)



# Abstractions in C#



**Interfaces**

**Abstract base classes**

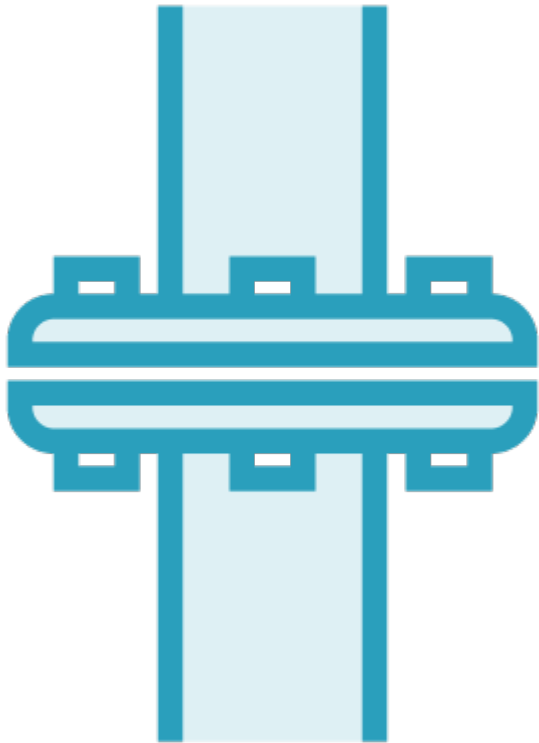
**“Types you can’t instantiate”**

# What about *details*?

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



# Details and Abstractions



**Abstractions shouldn't be coupled to details**

**Abstractions describe what**

- Send a message
- Store a Customer record

**Details specify how**

- Send an SMTP email over port 25
- Serialize Customer to JSON and store in a text file

# Depending on Details

```
public interface IOrderDataAccess
{
    SqlDataReader ListOrders(SqlParameterCollection params);
}
```



# Abstractions Should Not Depend on Details

```
public interface IOrderDataAccess
{
    List<Order> ListOrders(Dictionary<string, string> params);
}
```





# Low Level Dependencies



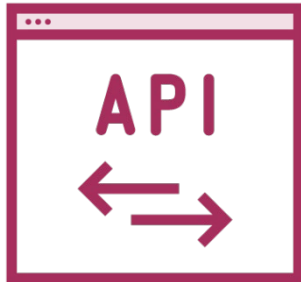
Database



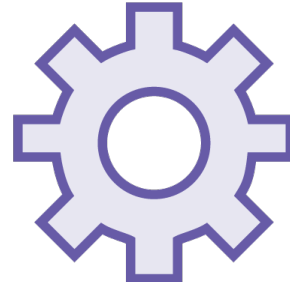
File system



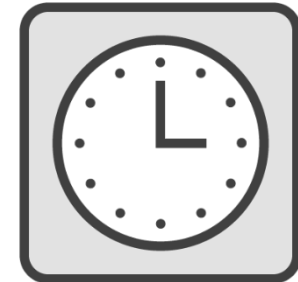
Email



Web APIs



Configuration



Clock

# Hidden Direct Dependencies



**Direct use of low level dependencies**

**Static calls and new**

**Causes pain**

- **Tight coupling**
- **Difficult to isolate and unit test**
- **Duplication**

# New Is Glue



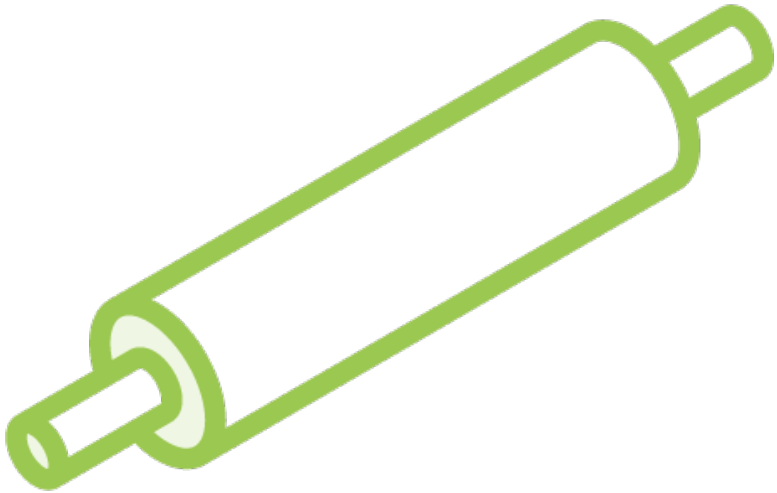
**Using new to create dependencies glues your code to that dependency**

- [ardalis.com/new-is-glue](https://ardalis.com/new-is-glue)

**New isn't bad – just bear in mind the coupling it creates**

- Do you need to specify the implementation?
- Could you use an abstraction instead?

# Explicit Dependencies Principle



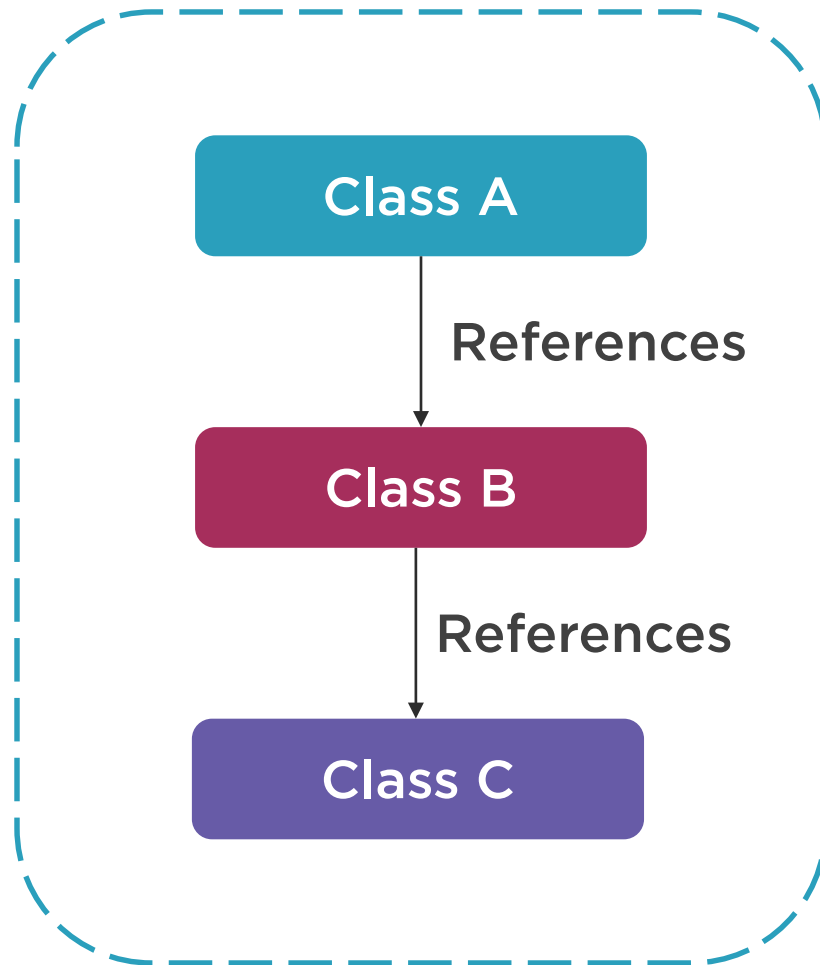
**Your classes shouldn't surprise clients with dependencies**

**List them up front, in the constructor**

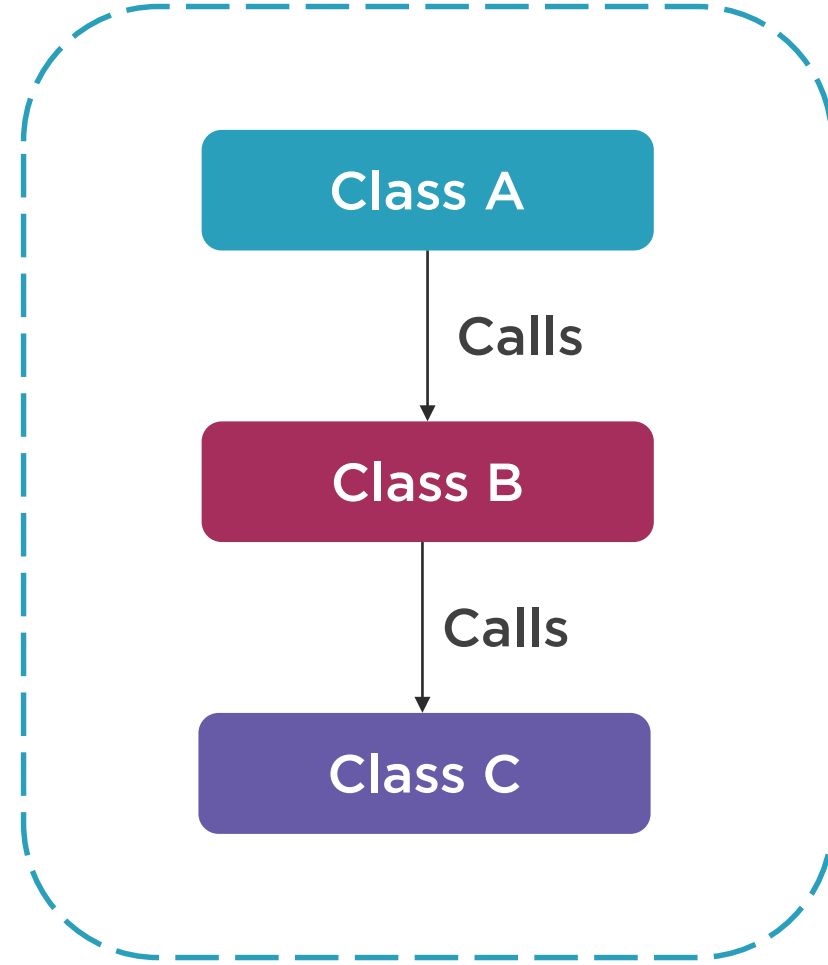
**Think of them as ingredients in a cooking recipe**

# Dependencies without Abstractions

Compile Time

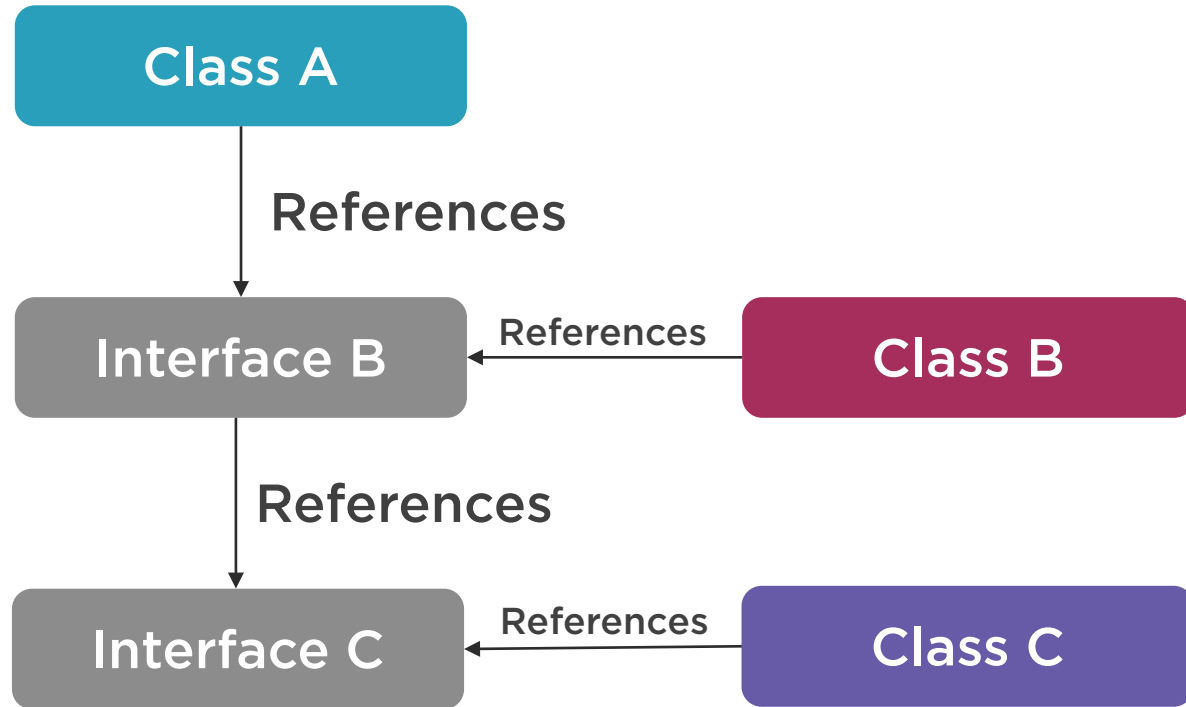


Run Time Control Flow

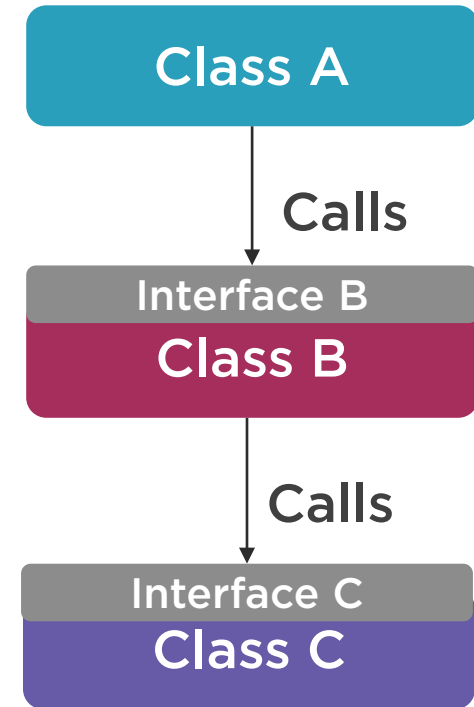


# Dependencies **with** Abstractions

Compile Time



Run Time Control Flow



# Learn More



## Microsoft Docs: Architectural Principles

- [bit.ly/2tmcebj](https://bit.ly/2tmcebj)

## Explicit Dependencies Principle

- [bit.ly/2lea2Nu](https://bit.ly/2lea2Nu)



# Dependency Injection



## Don't create your own dependencies

- Depend on abstractions
- Request dependencies from client

## Client injects dependencies as

- Constructor arguments
- Properties
- Method arguments

**See also:** Strategy Design Pattern



## Tip: Prefer Constructor Injection



**Follows Explicit Dependencies Principle**

**Classes are never in uninitialized state**

**Can leverage an IOC container to construct types and their dependencies**

IOC, or “Inversion of Control” containers are sometimes called “dependency injection” (DI) containers or simply services containers.

# Demo



## Applying DIP to ArdalisRating

Available at

<https://github.com/ardalis/solidsample>



# SOLID Principles

Single  
Responsibility  
Principle



Open / Closed  
Principle



Liskov  
Substitution  
Principle



Interface  
Segregation  
Principle



Dependency  
Inversion Principle



Too many files?







Use folders!



# Demo



Organizing ArdalisRating and Supporting  
a Web Front End

Available at  
<https://github.com/ardalis/solidsample>



# Key Takeaways



Most classes should **depend on abstractions**, not implementation details

**Abstractions** shouldn't leak details

Classes should **be explicit** about their dependencies

Clients should **inject dependencies** when they create other classes

**Structure your solutions** to leverage dependency inversion



# Course Summary



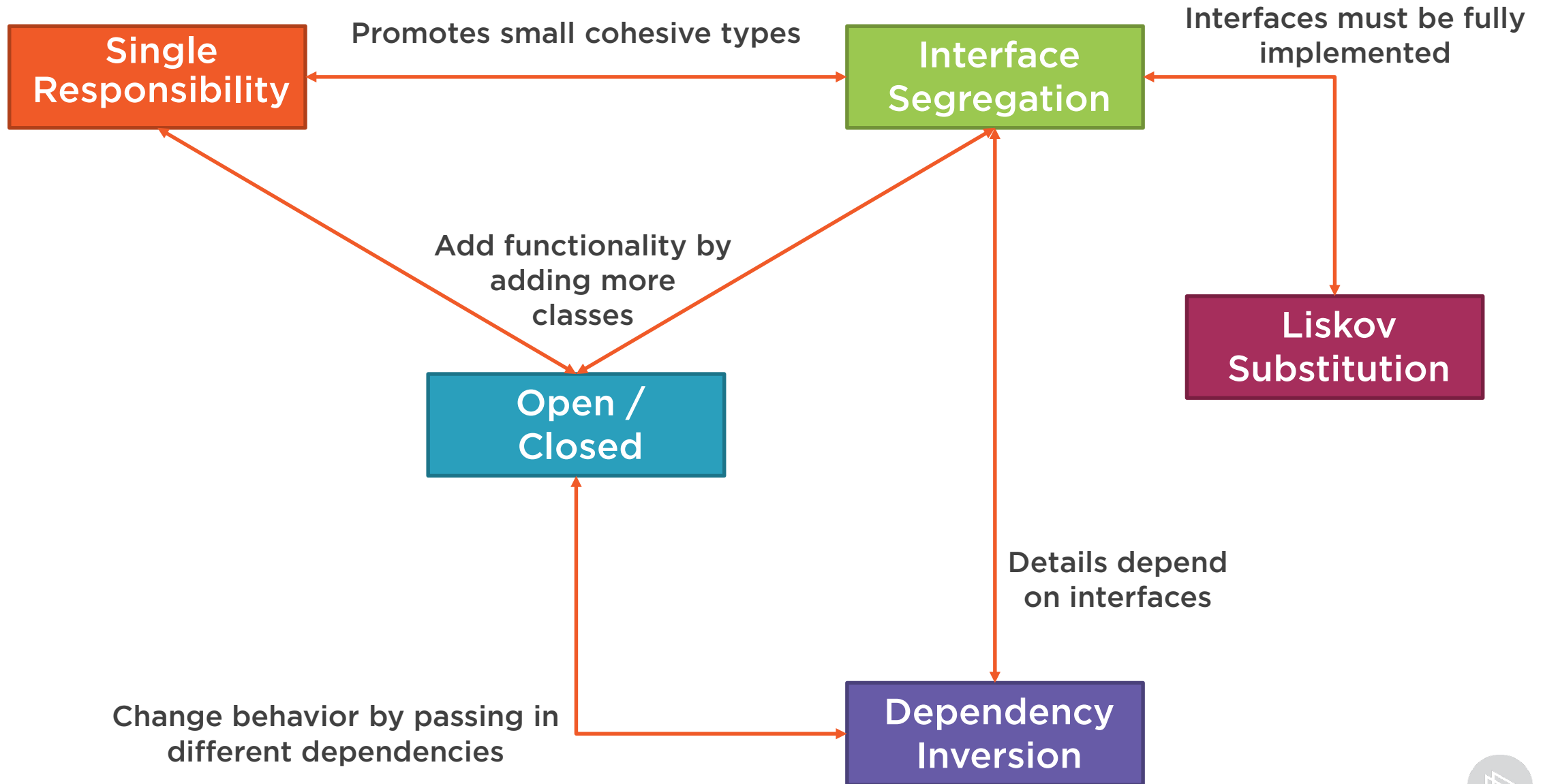
**Review principles – see next slide**

**Code Samples**

- <https://github.com/ardalis/solidsample>







# SOLID Principles for C# Developers

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