

Association between Classes



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Class Coupling



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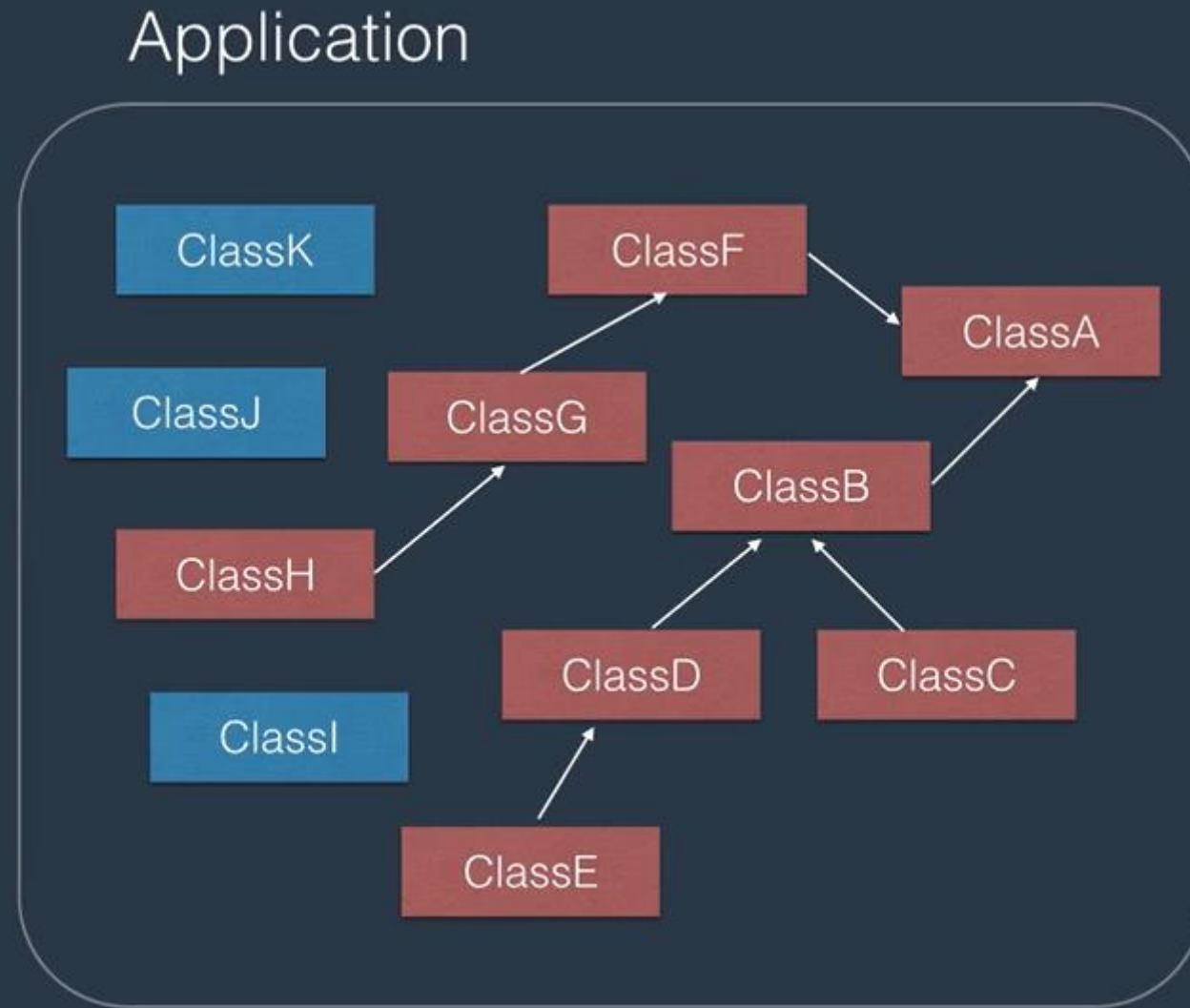
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What is Coupling?

A measure of how interconnected classes and subsystems are.



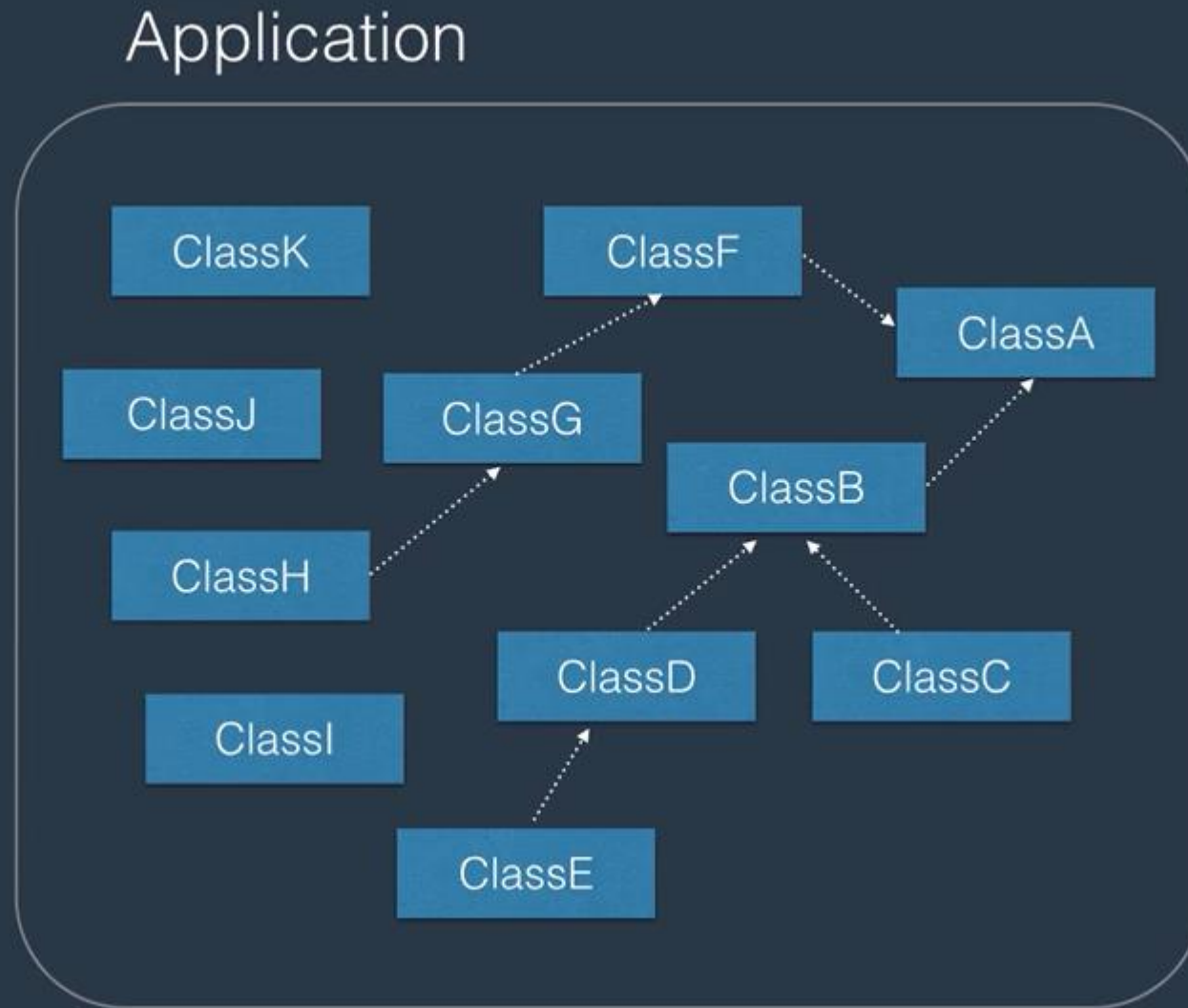
Tightly Coupled



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Loosely Coupled



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But how?

You need to understand

- Encapsulation
- The relationships between classes
- Interfaces



Types of Relationships

- Inheritance
- Composition



Agenda

- Inheritance
- Composition
- Favour Composition over Inheritance



Inheritance



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Agenda

- What is Inheritance?
- What are the benefits?
- UML Notation
- Syntax



What is Inheritance?

- A kind of relationship between two classes that allows one to inherit code from the other.
- Is-A
- Example: A Car is a Vehicle.



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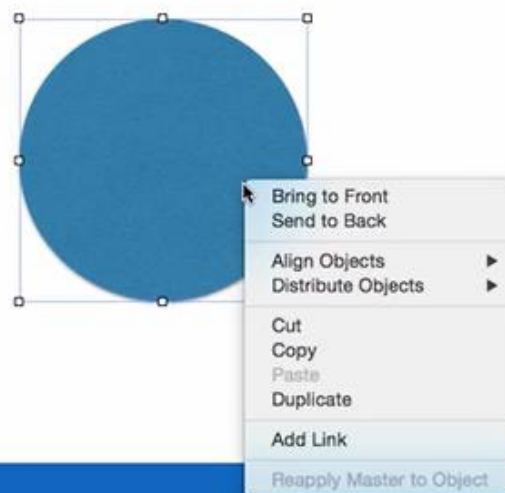
Benefits

- Code re-use
- Polymorphic behaviour





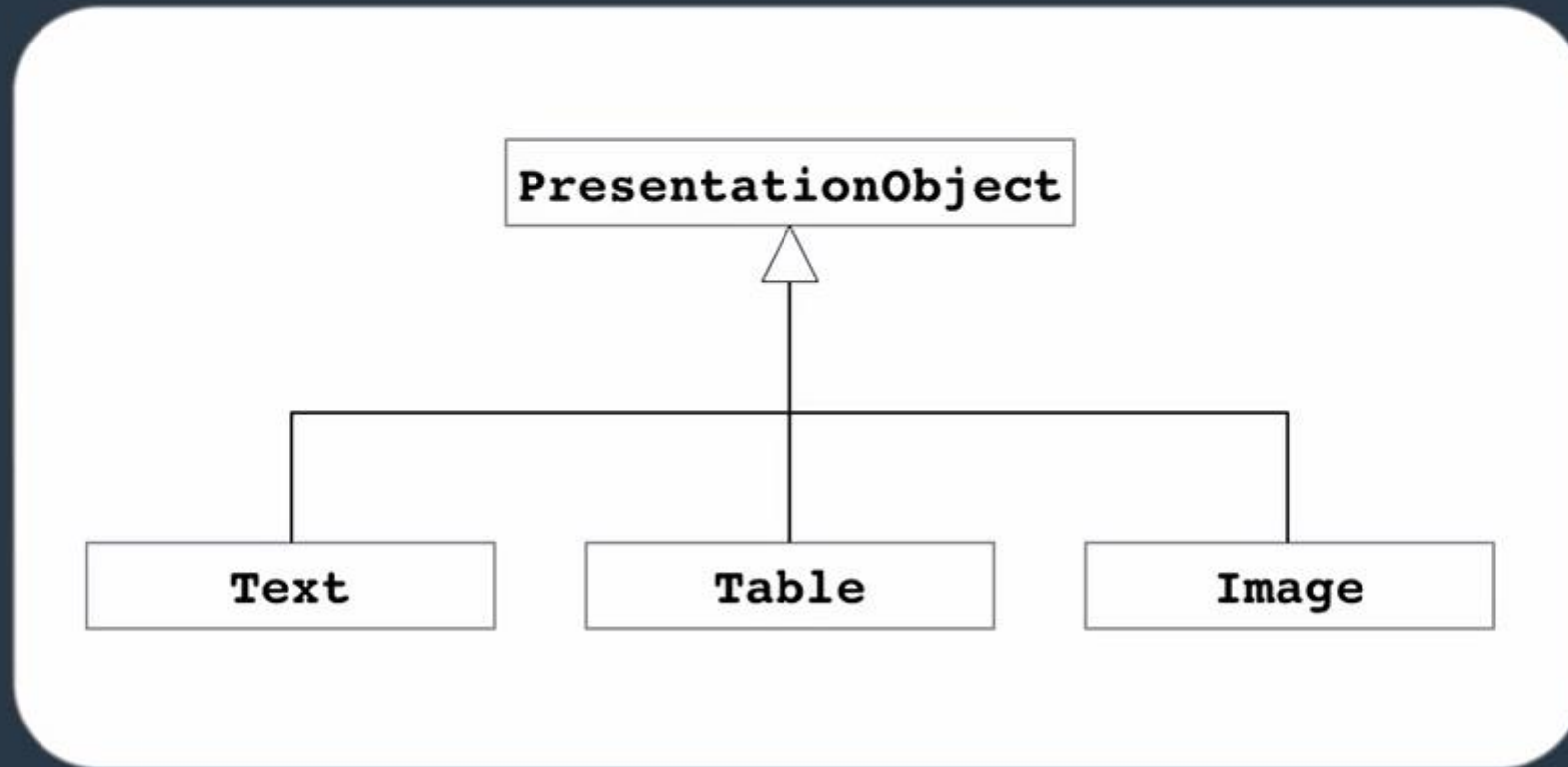
Double-click to edit



In UML

Parent / Base class

Child / Derived class



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Syntax

```
public class PresentationObject  
{  
    // Common shared code  
}
```

```
public class Text : PresentationObject  
{  
    // Code specific to Text  
}
```

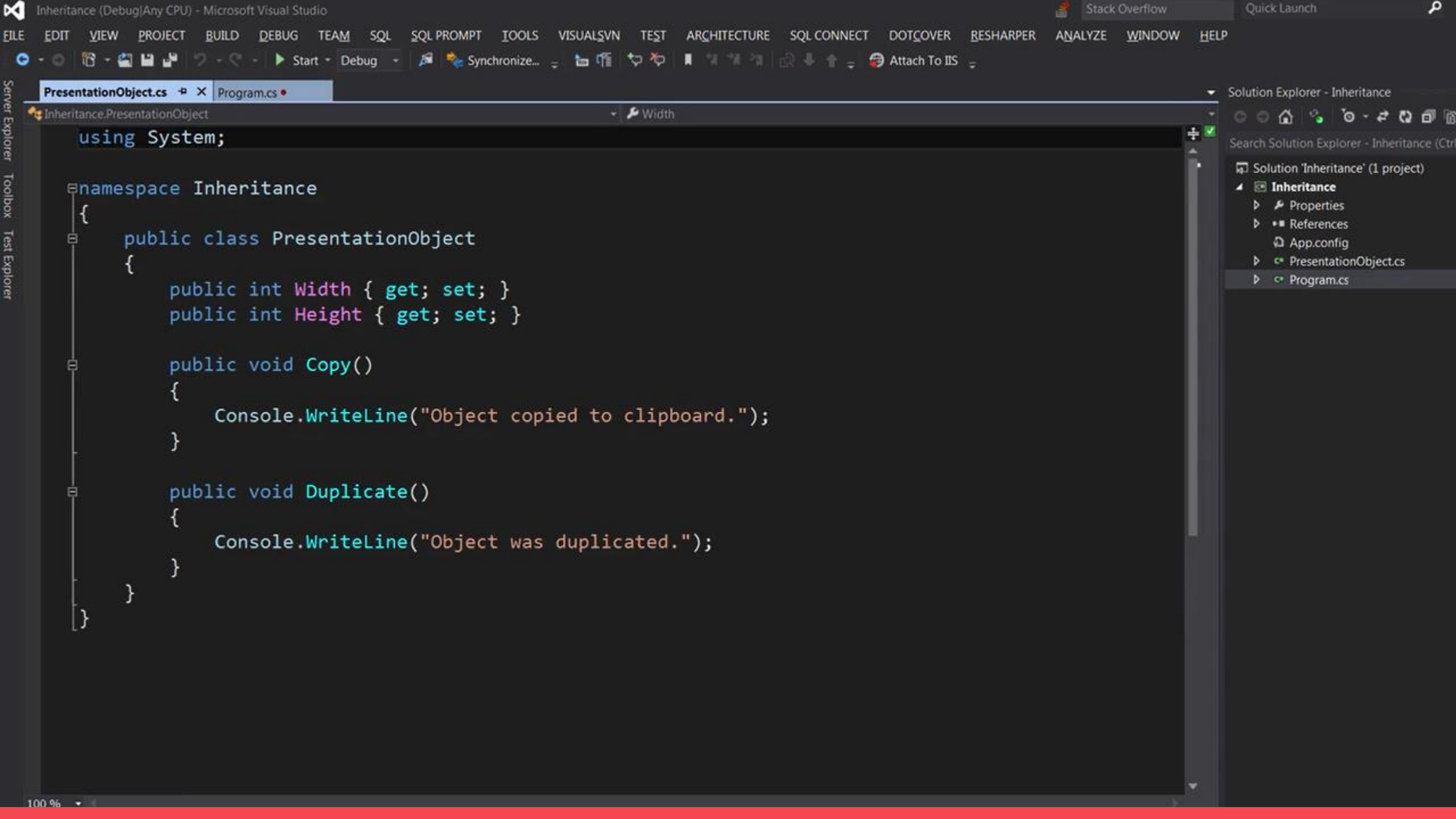


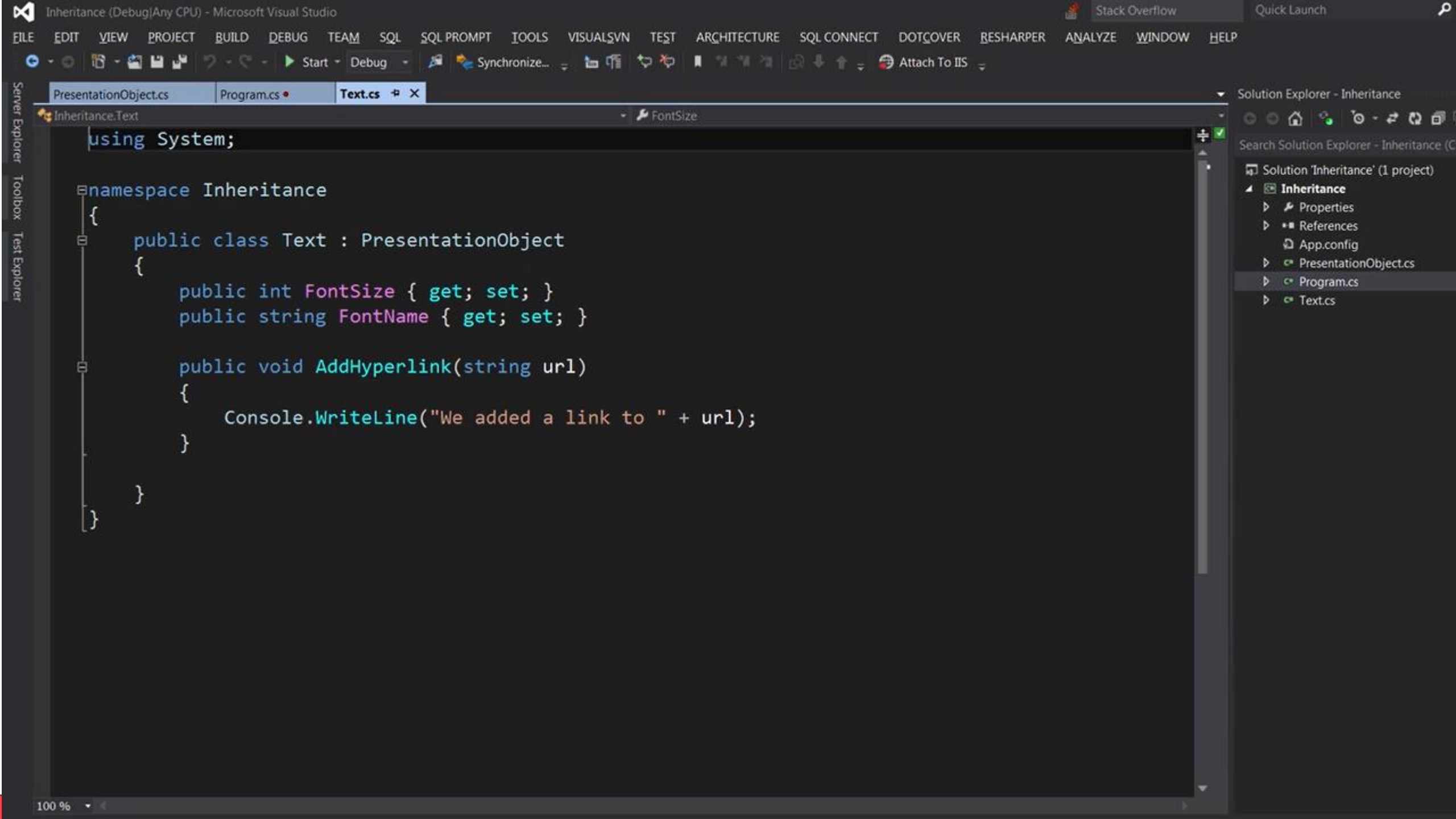
Demo Inheritance

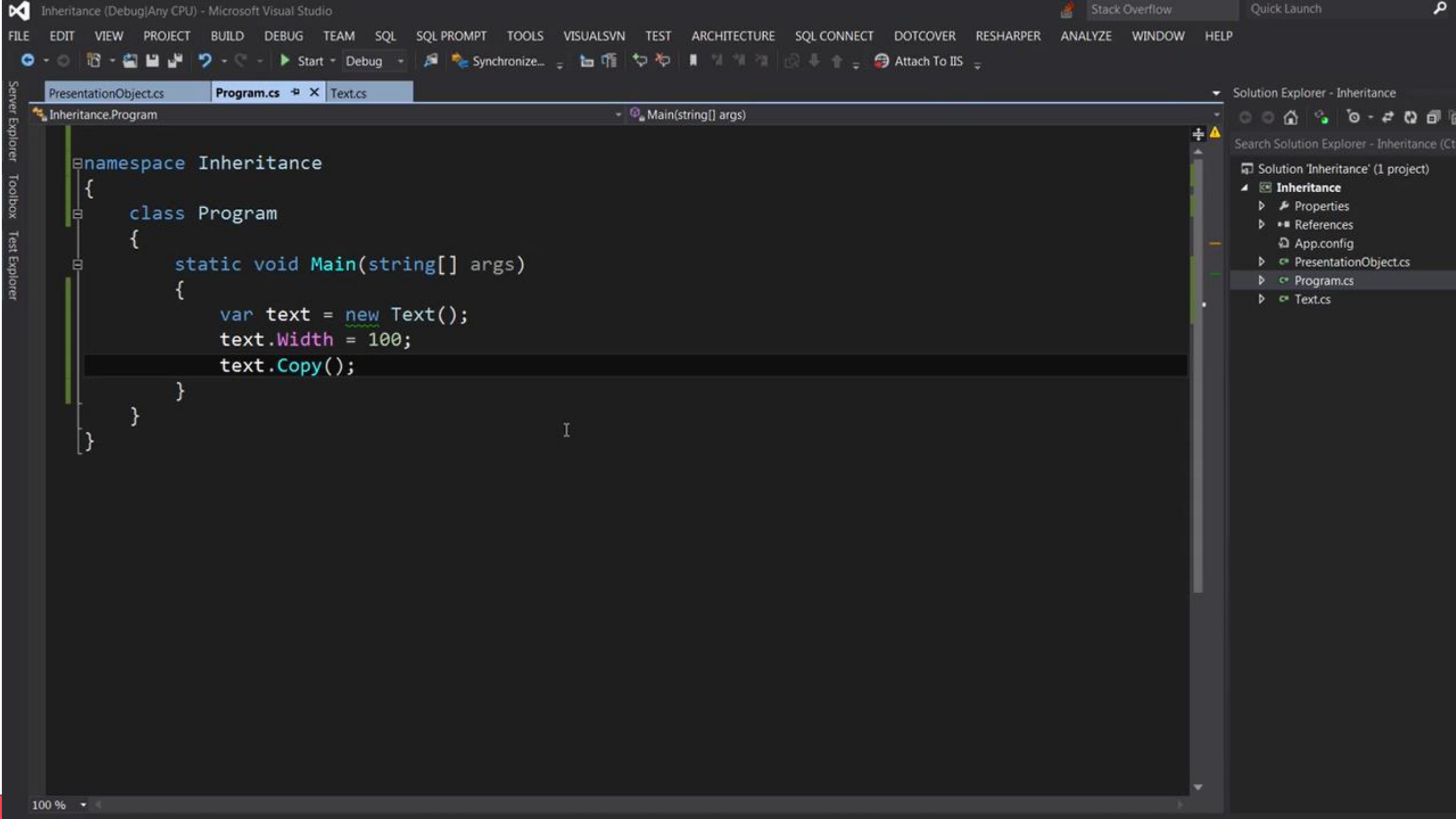


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Composition



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Agenda

- What is Composition?
- What are the benefits?
- UML Notation
- Syntax



What is Composition?

- A kind of relationship between two classes that allows one to contain the other.
- Has-a relationship
- Example: Car has an Engine



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Benefits

- Code re-use
- Flexibility
- A means to loose-coupling

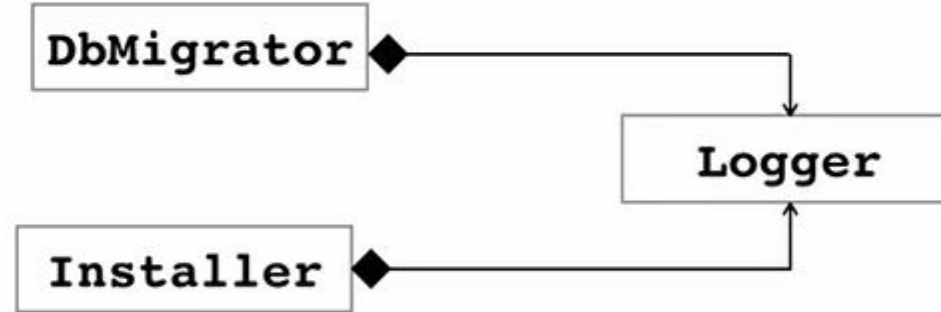


Example

- DbMigrator requires logging.
- Installer requires logging.



In UML



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Syntax

```
public class Installer
{
    private Logger _logger;

    public Installer(Logger logger)
    {
        _logger = logger;
    }
}
```



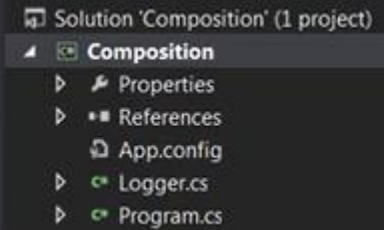
Demo Composition



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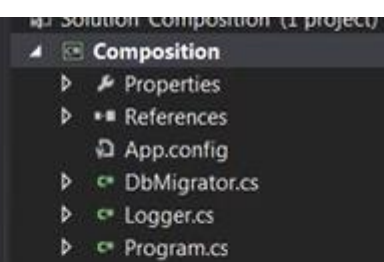
```
namespace Composition
{
    public class Logger
    {
        public void Log(string message)
        {
            Console.WriteLine(message);
        }
    }
}
```



```
public class DbMigrator
{
    private readonly Logger _logger;

    public DbMigrator(Logger logger)
    {
        _logger = logger;
    }

    public void Migrate()
    {
        _logger.Log("We are migrating blah blah blah...");
    }
}
```



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```
public class Installer
{
    private readonly Logger _logger;

    public Installer(Logger logger)
    {
        _logger = logger;
    }

    public void Install()
    {
        _logger.Log("We are installing the application.");
    }
}
```

Composition

- Properties
- References
- App.config
- DbMigrator.cs
- Installer.cs
- Logger.cs
- Program.cs

```
static void Main(string[] args)
{
    var dbMigrator = new DbMigrator(new Logger());

    var logger = new Logger();
    var installer = new Installer(logger);

    dbMigrator.Migrate();

    installer.Install();
}
```

App.config

- DbMigrator.cs
- Installer.cs
- Logger.cs
- Program.cs

Favour Composition over Inheritance



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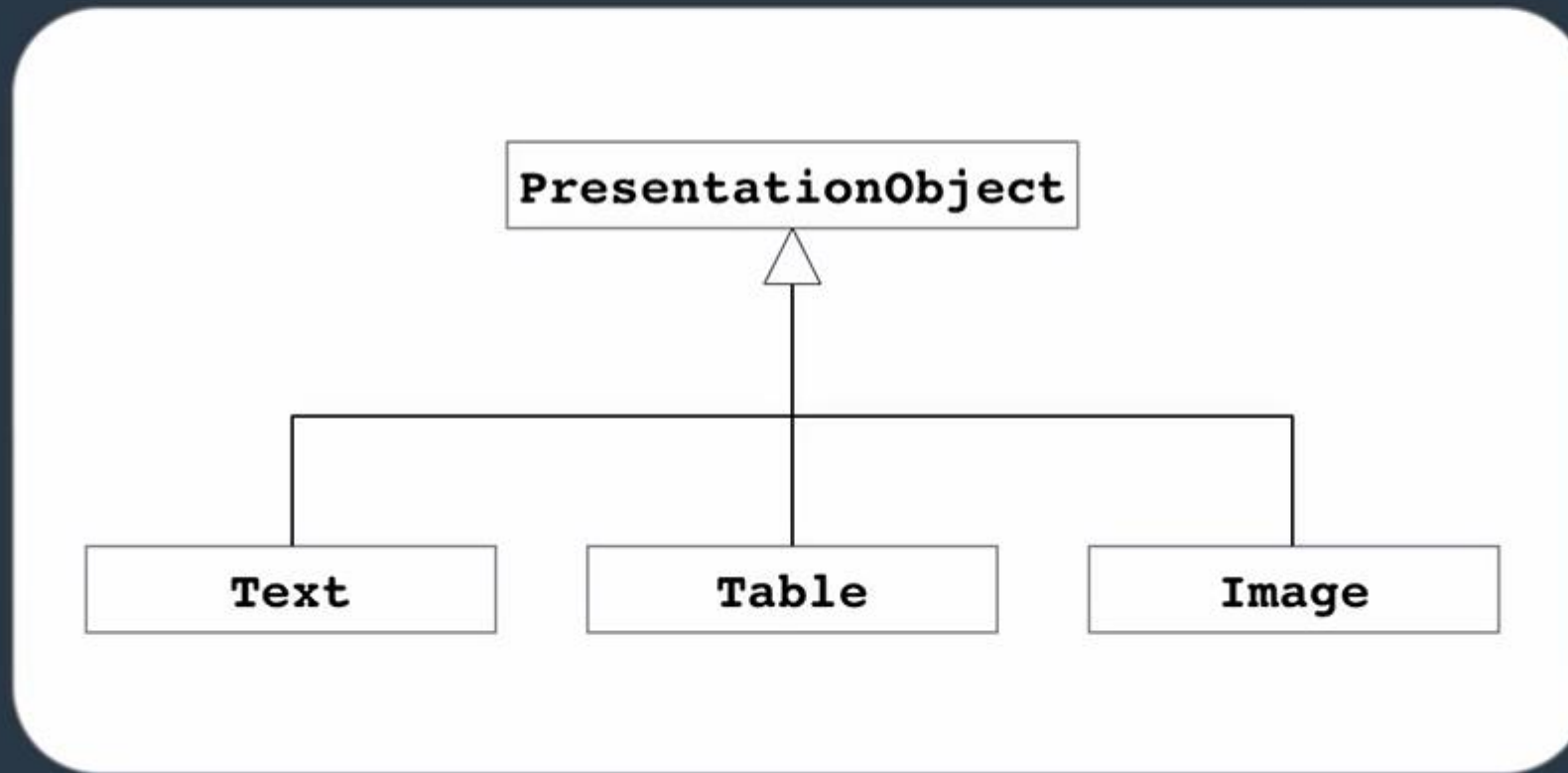
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Agenda

- Problems with Inheritance
- Advantages of Composition over Inheritance



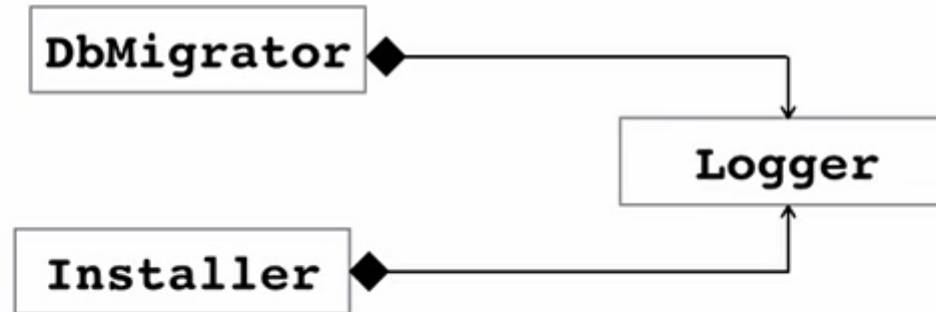
Code Reuse with Inheritance



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Code Reuse with Composition



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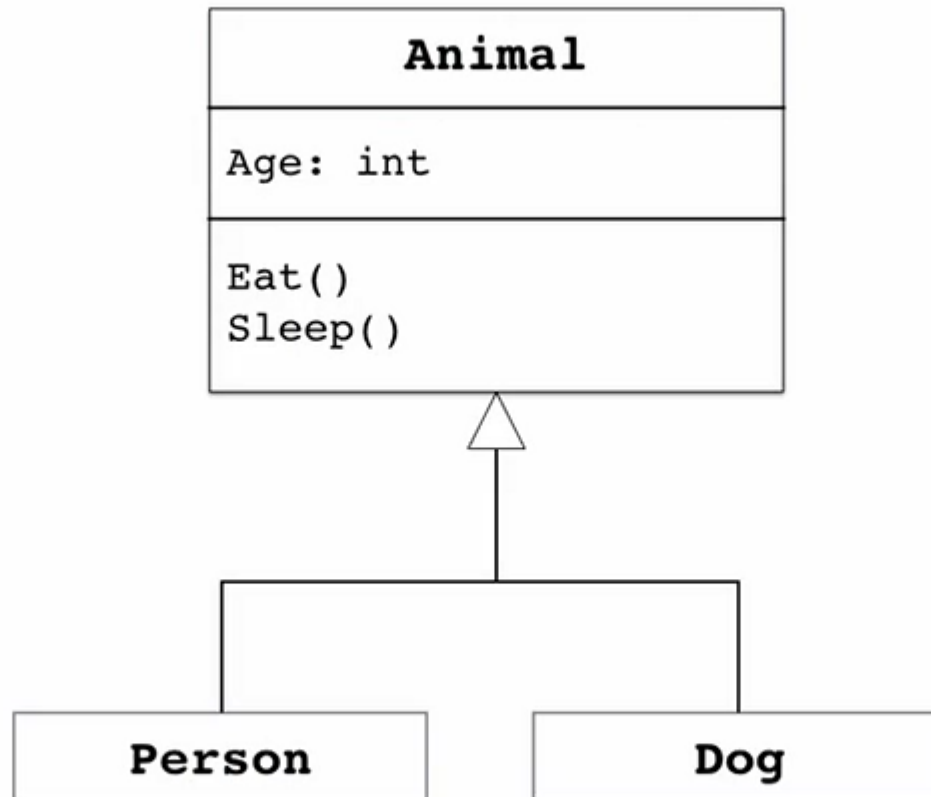
Problems with Inheritance

- Easily abused by amateur designers / developers
- Large hierarchies
- Fragility
- Tightly coupling



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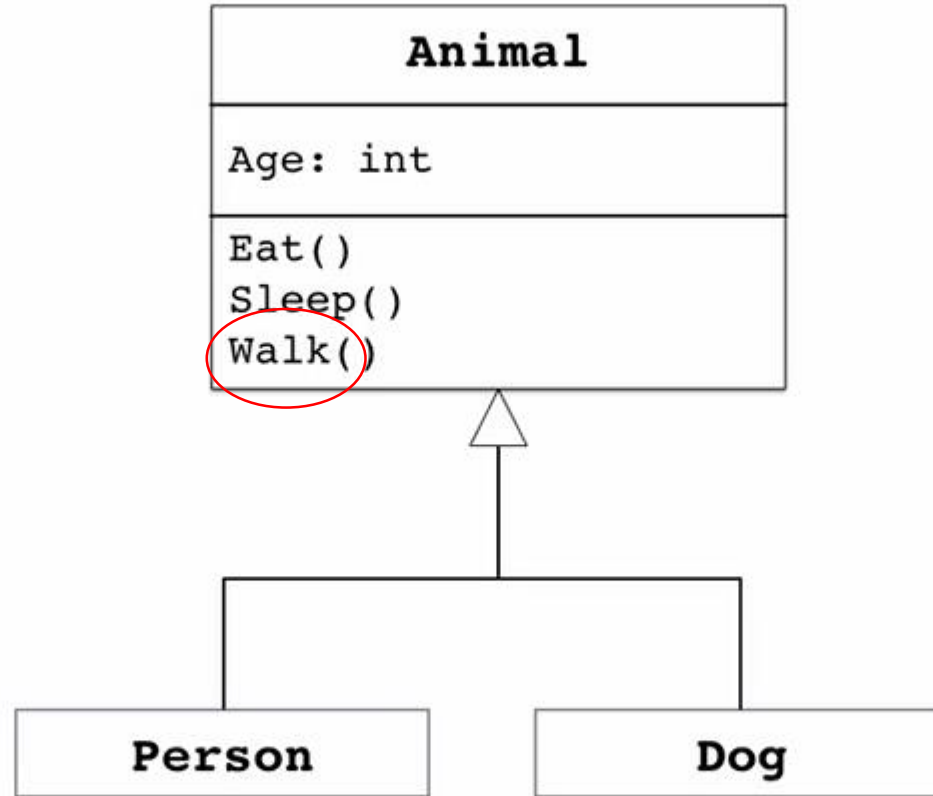
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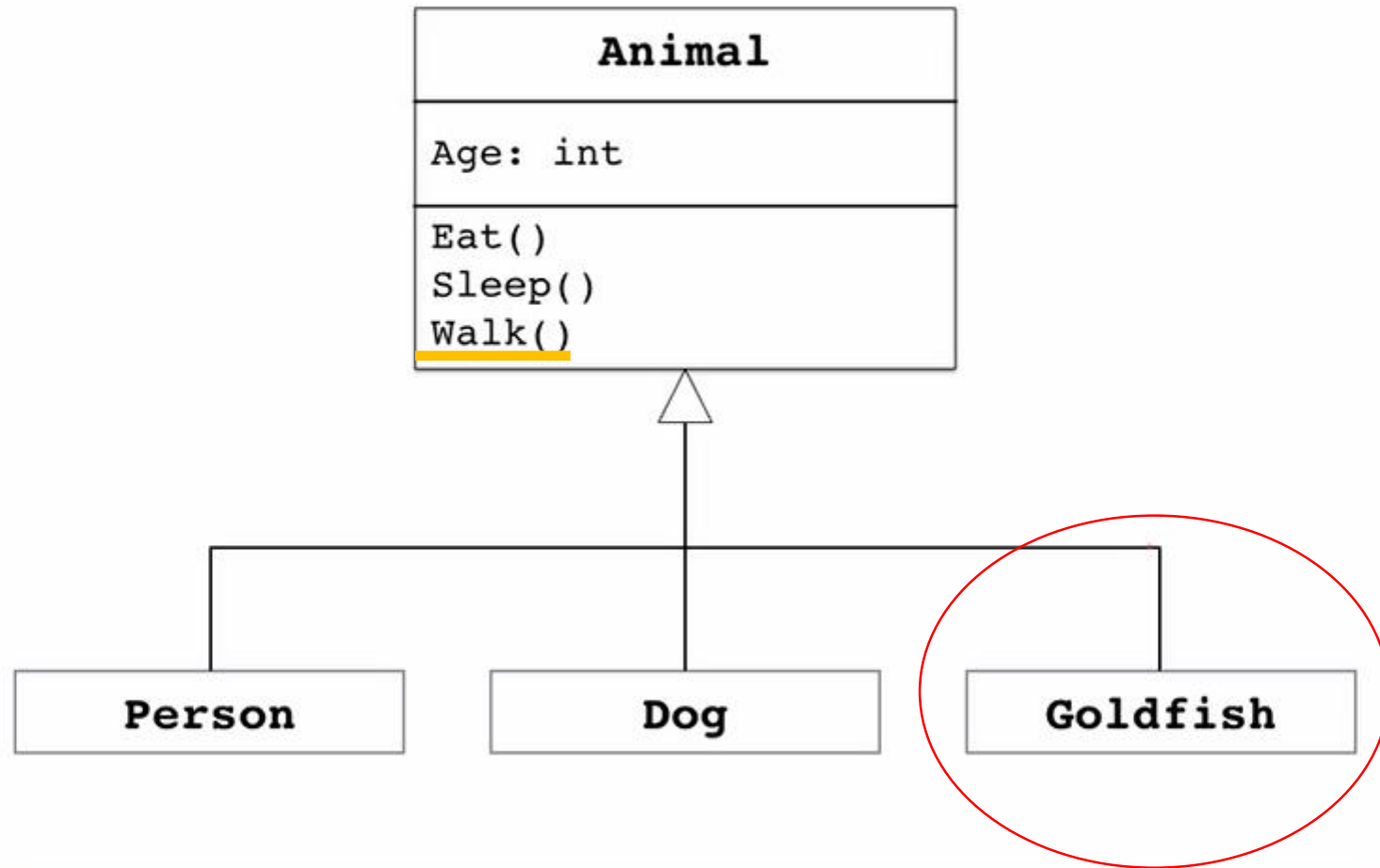
Add Walk()



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Add Goldfish



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Problems with Inheritance

- Easily abused by amateur designers / developers
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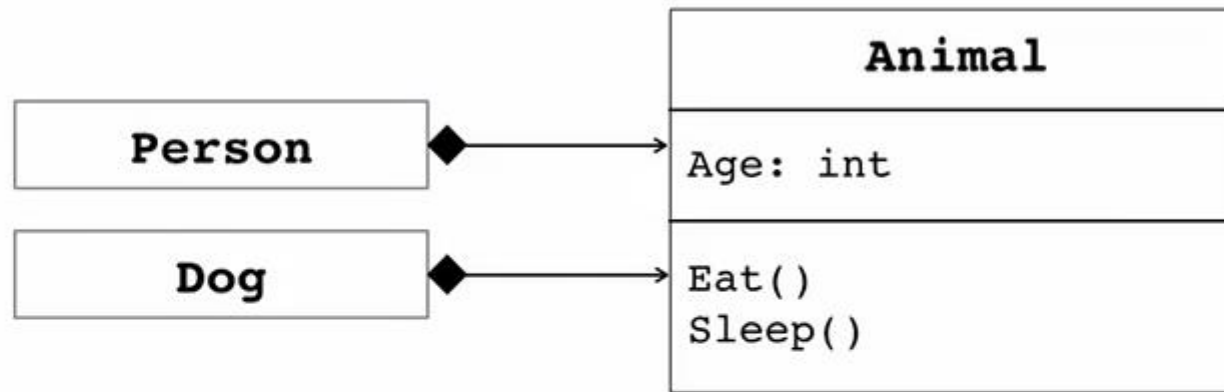
Composition

- Any Inheritance relationship can be translated to Composition.



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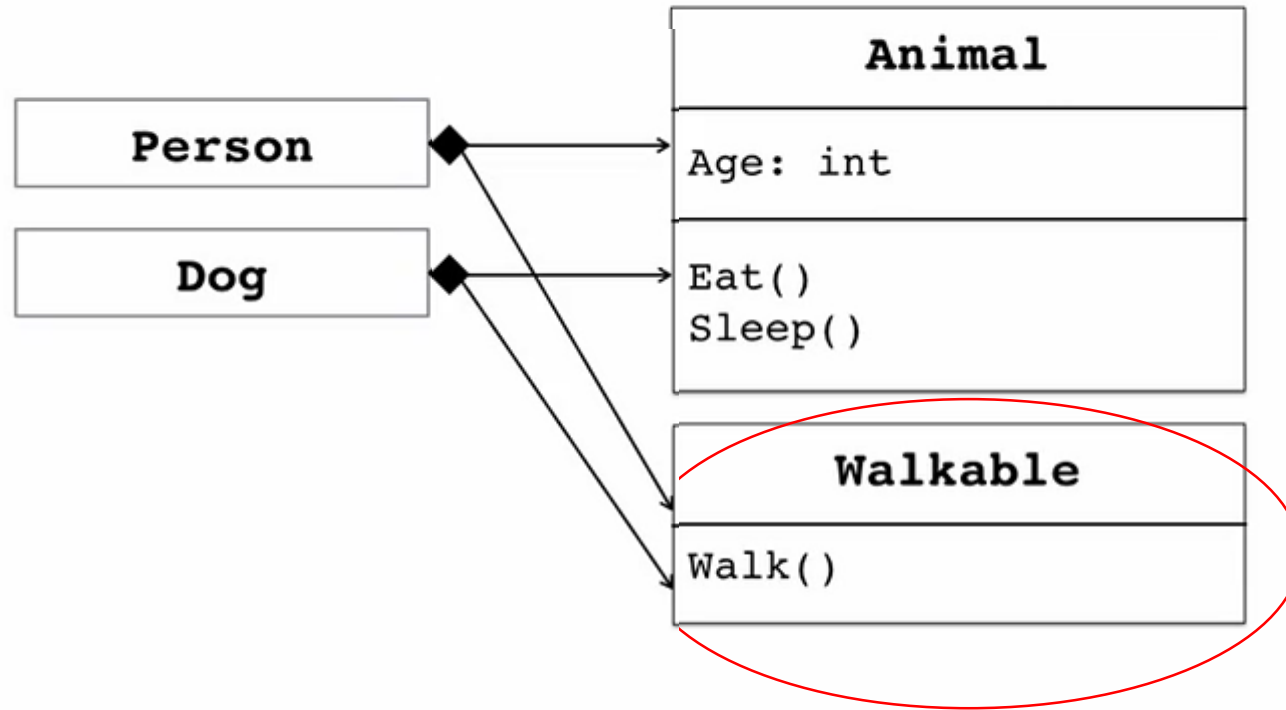
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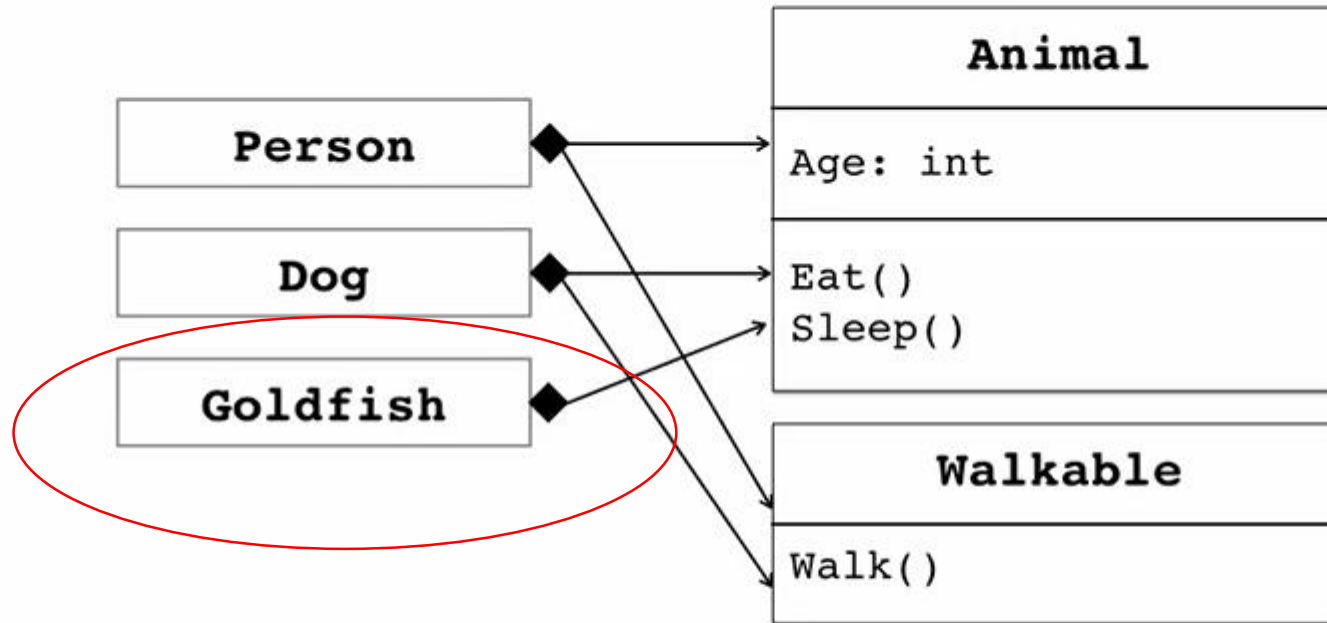
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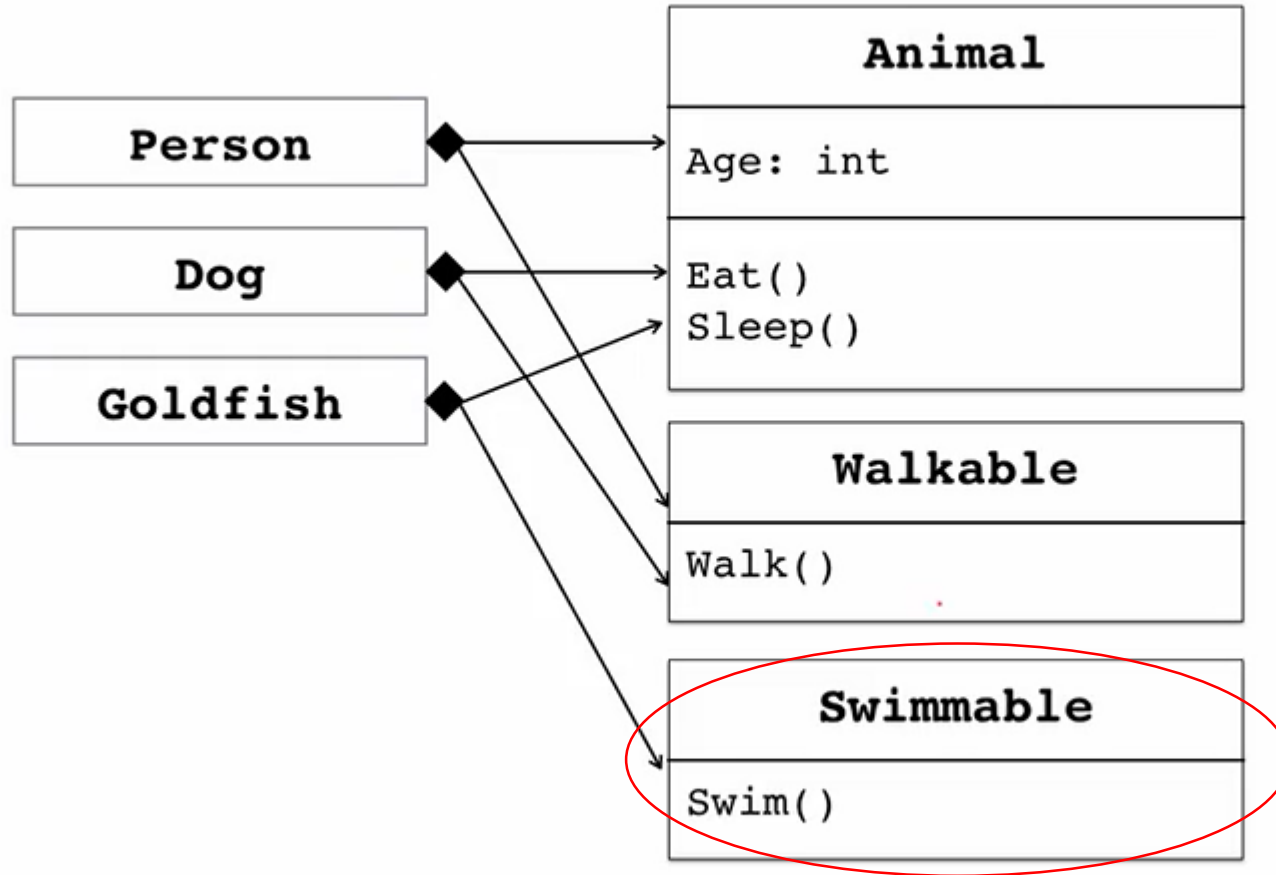
Add GoldFish



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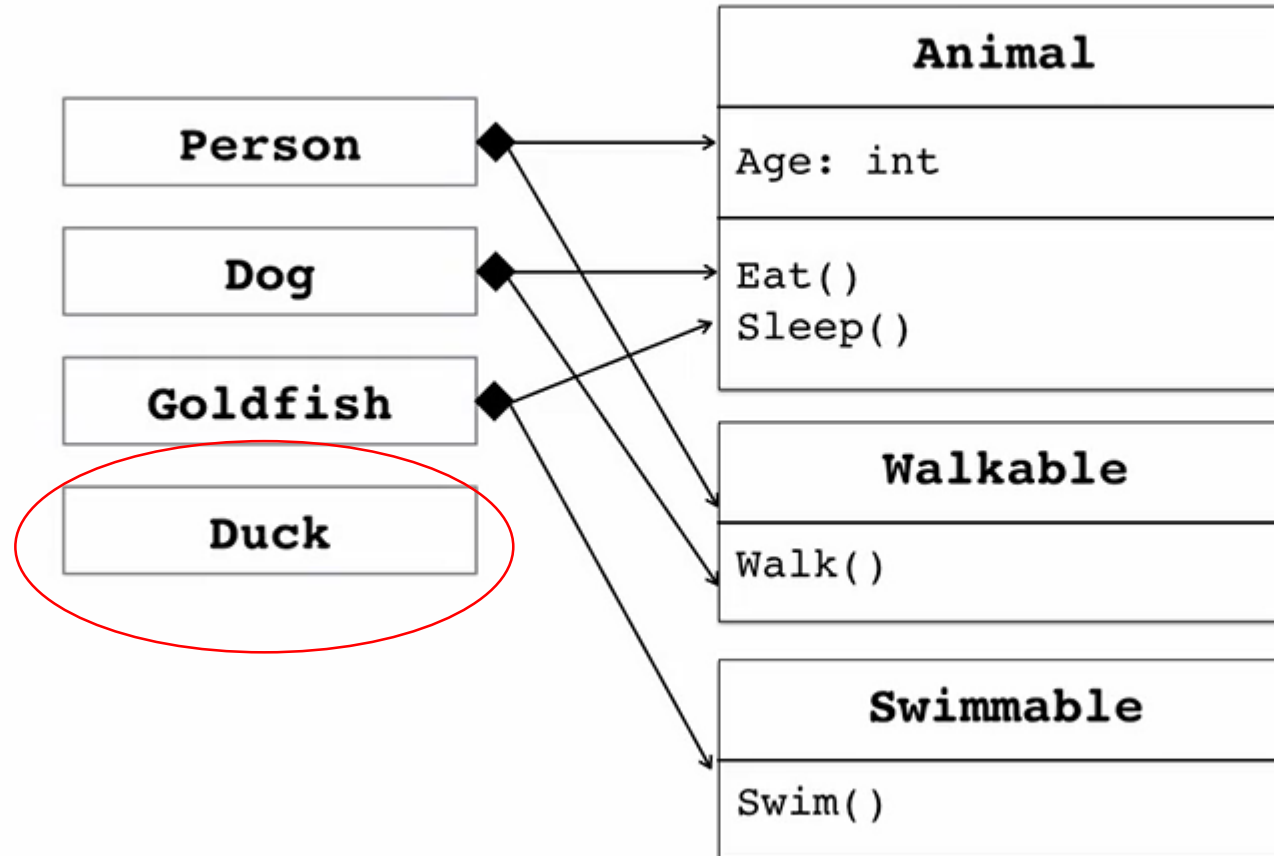
Add Swim()



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Add Duck



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Benefits of Composition

- Great flexibility
- Eventually loose coupling



Coupling



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Summary

- 2 types of relationship between classes
 - Inheritance (Is-a)
 - Composition (Has-a)



Summary

- Inheritance
 - Pros: Code re-use, easier to understand
 - Cons: Tightly coupled, fragile, can be abused



Summary

- Composition
 - Pros: Code re-use, great flexibility, loose coupling
 - Cons: A little harder to understand



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Summary

- Inheritance is not necessarily a bad thing.
- Use both Inheritance and Composition.

