Pontificia Universidad Católica de Chile
Escuela de Ingeniería
Departamento de Ciencia de la Computación

Clase 2
Diseño de Componentes

IIC2113 – Diseño Detallado de Software

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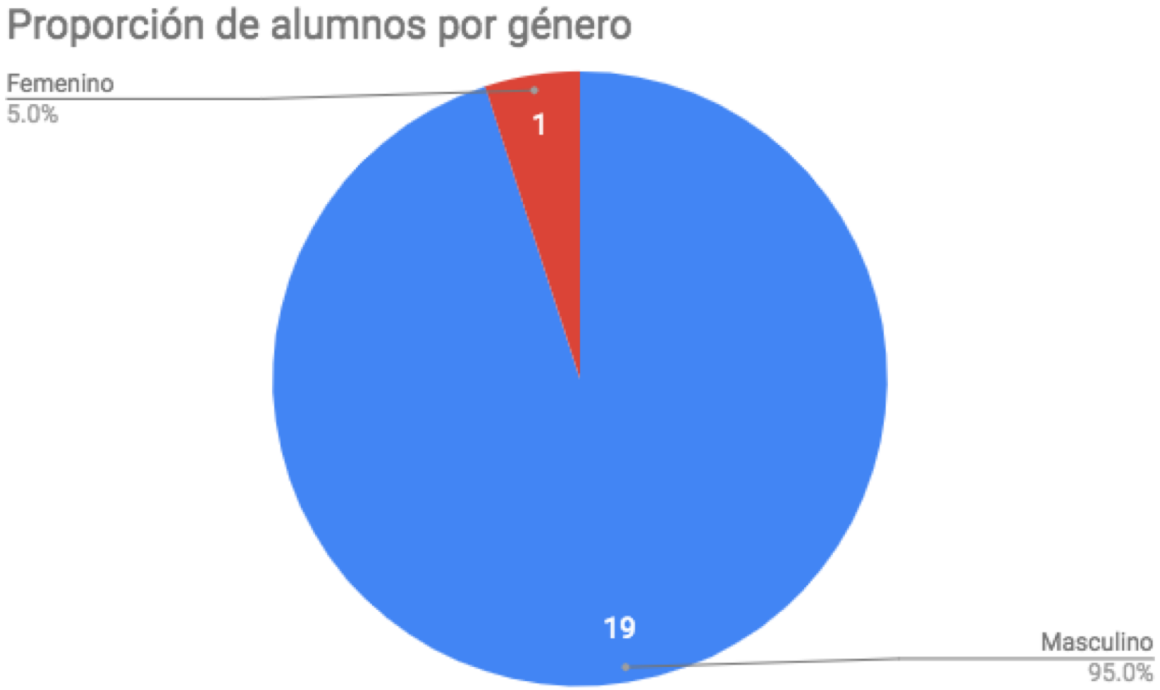
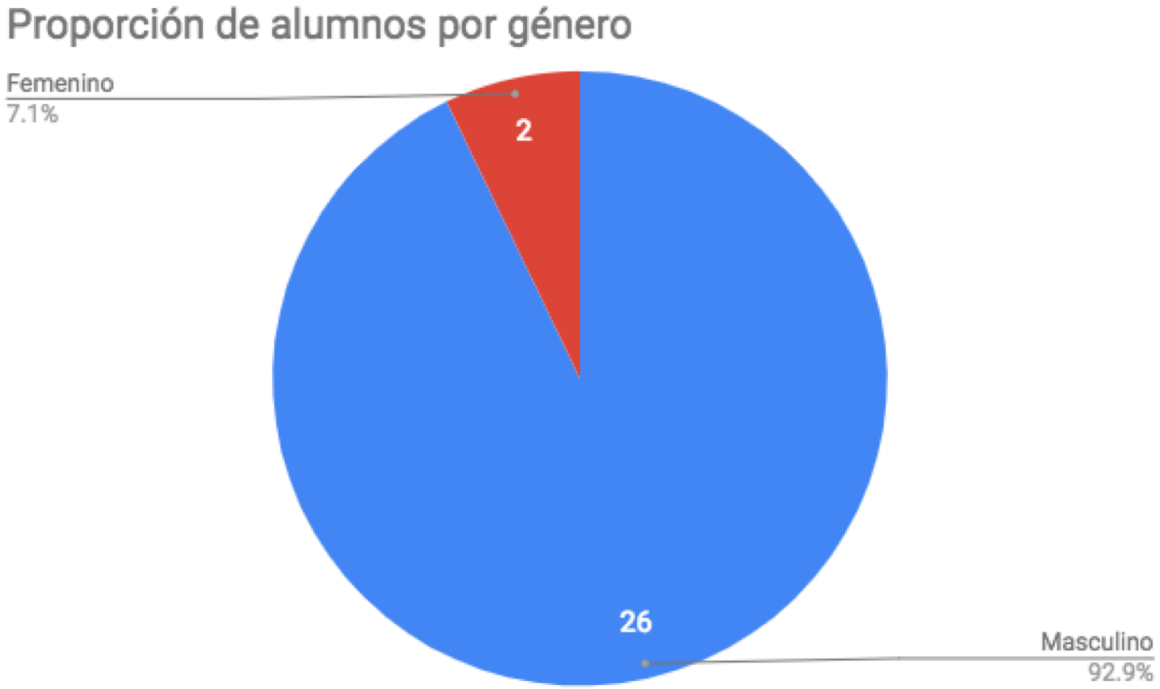
Estadísticas del curso

- 2016 – 2: 20 alumnos



Estadísticas del curso

- 2017 – 2: 28 alumnos



Estadísticas del curso

- 2018 – 2: 70 alumnos

Estadísticas del curso

- GitHub

https://www.research.net/r/97ZLPMH

Actividad 1

Modelo 4 + 1:

- Diagrama de clases
- Diagrama de secuencia
- Diagrama de actividad
- Diagrama de componentes
- Diagrama de despliegue
- Diagrama de casos de uso

Diseño de componentes de software

Conceptos básicos:

- Herencia: Mecanismo a través del cual una clase **Y** hereda los atributos y métodos de una clase **X**.

```ruby
class Bird
  def preen
    puts "I am cleaning my feathers."
  end
  def fly
    puts "I am flying."
  end
end

class Penguin < Bird
  def fly
    puts "Sorry. I'd rather swim."
  end
end
```

Diseño de componentes de software

Conceptos básicos:

- Herencia: Mecanismo a través del cual una clase **Y** hereda los atributos y métodos de una clase **X**.
- Promueve la reusabilidad, disminuyendo costos de desarrollo y mantenibilidad.
- Su mal uso puede conllevar a todo lo contrario.
  - Dificulta legibilidad
  - Introduce acoplamiento entre padres e hijos.

Diseño de componentes de software

Conceptos básicos:

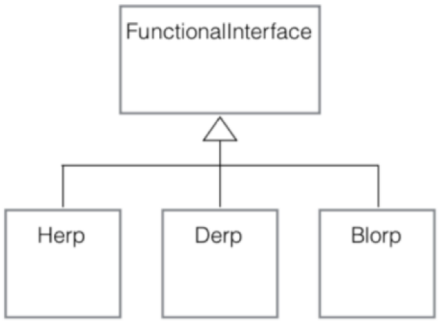
- Interfaz: Colección de operaciones (métodos) que las clases concretas deben implementar.
- Se pueden interpretar como un contrato.

```
class FunctionalInterface
  def do_thing
    raise "This is not implemented!"
  end
end

class Herp < FunctionalInterface
  def do_thing
    puts "herp"
  end
end

class Derp < FunctionalInterface
  def do_thing
    puts "derp"
  end
end

class Blorp < FunctionalInterface
  def do_some_other_thing
    puts "whoops"
  end
end
```



Diseño de componentes de software

Conceptos básicos:

- Interfaz: Colección de operaciones (métodos) que las clases concretas deben implementar.
- Se pueden interpretar como un contrato.
- Facilitan la extensibilidad del código

¿Cómo diseñar componentes de *software*?

Principios *S.O.L.I.D.*

- Propuestos por Robert C. Martin (cerca del 2000)
- Fomentan *software* fácil de mantener y extender

¿Cómo diseñar componentes de *software*?

Principios *S.O.L.I.D.*

- **S** – *Single-responsibility*
- **O** – *Open-Closed*
- **L** – *Liskov substitution*
- **I** – *Interface segregation*
- **D** – *Dependency Inversion*

Single-Responsibility principle

"A class should have only a single responsibility (one reason to change)"

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"A class should have only a single responsibility (one reason to change)"

```
public class InvitationService
{
    public void SendInvite(string email, string firstName, string lastName)
    {
        if(String.IsNullOrWhiteSpace(firstName) || String.IsNullOrWhiteSpace(lastName))
        {
            throw new Exception("Name is not valid!");
        }

        if(!email.Contains("@") || !email.Contains("."))
        {
            throw new Exception("Email is not valid!!");
        }
        SmtpClient client = new SmtpClient();
        client.Send(new MailMessage("mysite@nowhere.com", email) { Subject = "Please join me at
    }
}
```

Single-Responsibility principle

"A class should have only a single responsibility (one reason to change)"

```
public class UserNameService
{
    public void Validate(string firstName, string lastName)
    {
        if(String.IsNullOrWhiteSpace(firstName) || String.IsNullOrWhiteSpace(lastName))
        {
            throw new Exception("The name is invalid!");
        }
    }
}
```

```
public class EmailService
{
    public void Validate(string email)
    {
        if (!email.Contains("@") || !email.Contains("."))
        {
            throw new Exception("Email is not valid!!");
        }
    }
}
```

Single-Responsibility principle

"A class should have only a single responsibility (one reason to change)"

```
public class InvitationService
{
    UserNameService _userNameService;
    EmailService _emailService;

    public InvitationService(UserNameService userNameService, EmailService emailService)
    {
        _userNameService = userNameService;
        _emailService = emailService;
    }
    public void SendInvite(string email, string firstName, string lastName)
    {
        _userNameService.Validate(firstName, lastName);
        _emailService.Validate(email);
        SmtpClient client = new SmtpClient();
        client.Send(new MailMessage("sitename@invites2you.com", email) { Subject = "Please join me
    }
}
```

Single-Responsibility principle

"A class should have only a single responsibility (one reason to change)"

```
$shapes = array(
    new Circle(2),
    new Square(5),
    new Square(6)
);

$areas = new AreaCalculator($shapes);

echo $areas->output();
```

Single-Responsibility principle

"A class should have only a single responsibility (one reason to change)"

```
$shapes = array(
    new Circle(2),
    new Square(5),
    new Square(6)
);

$areas = new AreaCalculator($shapes);
$output = new SumCalculatorOutputter($areas);

echo $output->JSON();
echo $output->HAML();
echo $output->HTML();
echo $output->JADE();
```

Open-Closed principle

"A module should be open for extension but closed for modification"

Open-Closed principle

"A module should be open for extension but closed for modification"

```
public class Rectangle
{
    public double Width { get; set; }
    public double Height { get; set; }
}
```

```
public class Circle
{
    public double Radius { get; set; }
}
```

```
public class CombinedAreaCalculator
{
    public double Area(object[] shapes)
    {
        double area = 0;
        foreach (var shape in shapes)
        {
            if (shape is Rectangle)
            {
                Rectangle rectangle = (Rectangle)shape;
                area += rectangle.Width * rectangle.Height;
            }
        }
        return area;
    }
}
```

Open-Closed principle

"A module should be open for extension but closed for modification"

```
public class Rectangle
{
    public double Width { get; set; }
    public double Height { get; set; }
}
```

```
public class Circle
{
    public double Radius { get; set; }
}
```

```
public class CombinedAreaCalculator
{
    public double Area(object[] shapes)
    {
        double area = 0;
        foreach (var shape in shapes)
        {
            if (shape is Rectangle)
            {
                Rectangle rectangle = (Rectangle)shape;
                area += rectangle.Width * rectangle.Height;
            }
            if (shape is Circle)
            {
                Circle circle = (Circle)shape;
                area += (circle.Radius * circle.Radius) * Math.PI;
            }
        }

        return area;
    }
}
```

Open-Closed principle

"A module should be open for extension but closed for modification"

```
public abstract class Shape
{
    public abstract double Area();
}
```

```
public class Rectangle : Shape
{
    public double Width { get; set; }
    public double Height { get; set; }
    public override double Area()
    {
        return Width * Height;
    }
}
```

```
public class Circle : Shape
{
    public double Radius { get; set; }
    public override double Area()
    {
        return Radius * Radius * Math.PI;
    }
}
```

```
public class Triangle : Shape
{
    public double Height { get; set; }
    public double Width { get; set; }
    public override double Area()
    {
        return Height * Width * 0.5;
    }
}
```

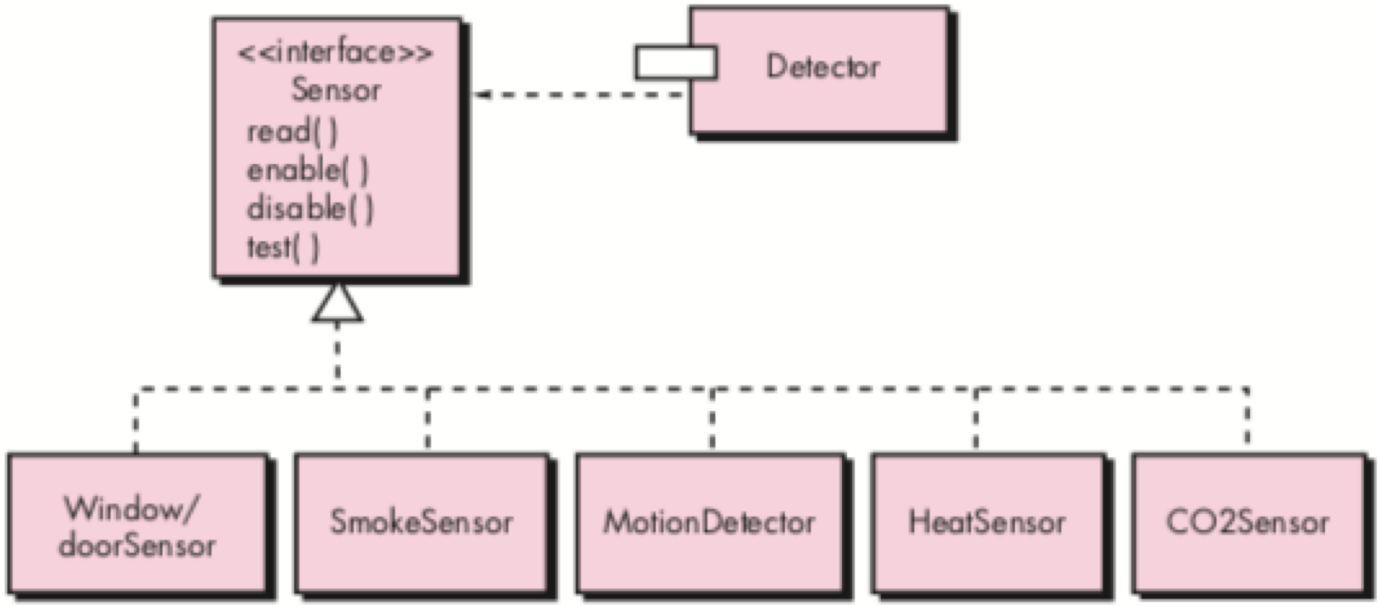
Open-Closed principle

"A module should be open for extension but closed for modification"

```
public class CombinedAreaCalculator
{
    public double Area(Shape[] shapes)
    {
        double area = 0;
        foreach (var shape in shapes)
        {
            area += shape.Area();
        }
        return area;
    }
}
```

Open-Closed principle

"A module should be open for extension but closed for modification"



Liskov Substitution principle

"Subclasses should be substituable for their base classes"

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"Subclasses should be substituable for their base classes"

```
class Bird {
  public void fly(){}
  public void eat(){}
}
class Crow extends Bird {}
class Ostrich extends Bird{
  fly(){
    throw new UnsupportedOperationException();
  }
}
```

```
public BirdTest{
  public static void main(String[] args){
    List<Bird> birdList = new ArrayList<Bird>();
    birdList.add(new Bird());
    birdList.add(new Crow());
    birdList.add(new Ostrich());
    letTheBirdsFly ( birdList );
  }
  static void letTheBirdsFly ( List<Bird> birdList ){
    for ( Bird b : birdList ) {
      b.fly();
    }
  }
}
```

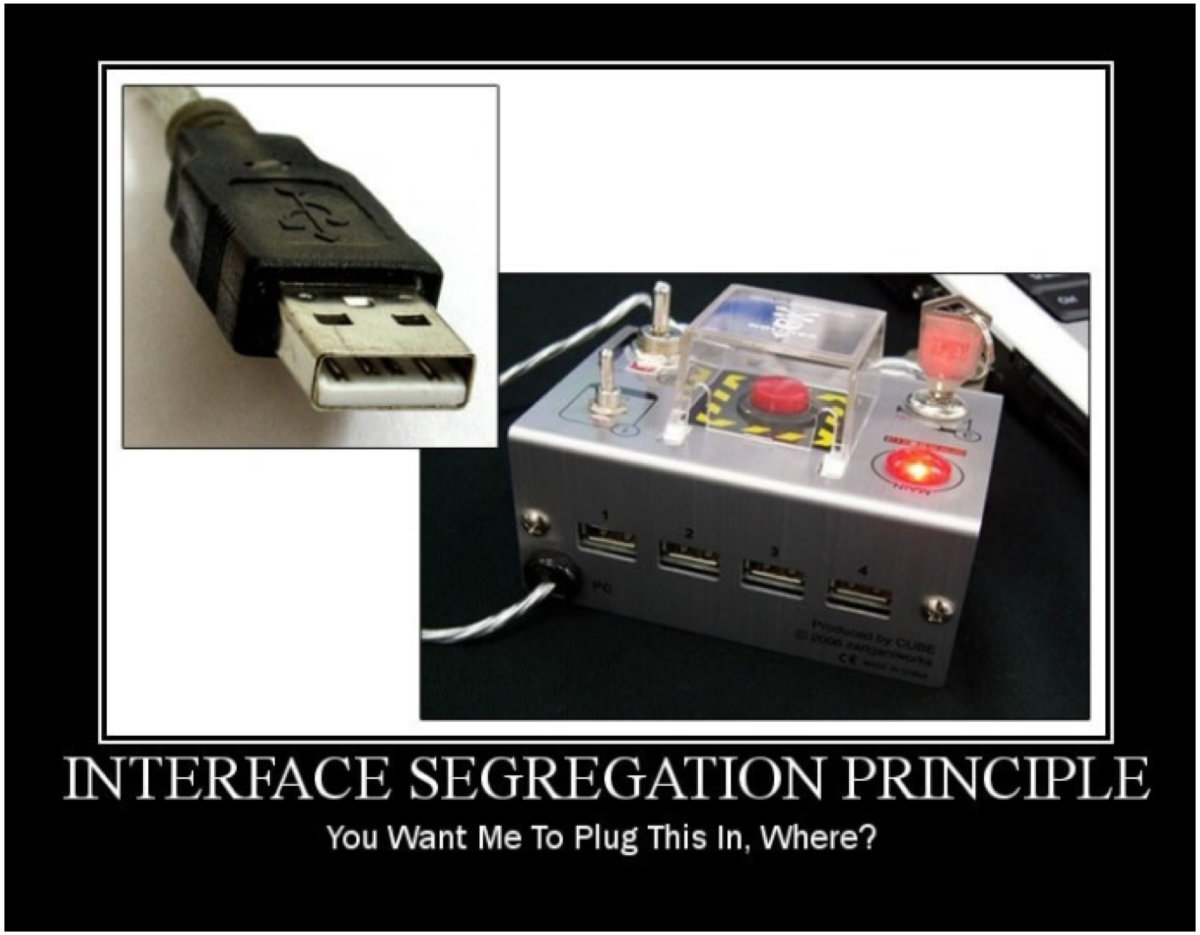
Liskov Substitution principle

"Subclasses should be substituable for their base classes"

```
class Bird{
  public void eat(){}
}
class FlightBird extends Bird{
  public void fly()()
}
class NonFlight extends Bird{}
```

Interface Segregation principle

"Many client-specific interfaces are better than one general purpose interface"



Interface Segregation principle

"Many client-specific interfaces are better than one general purpose interface"

```
interface ShapeInterface {
    public function area();
    public function volume();
}
```

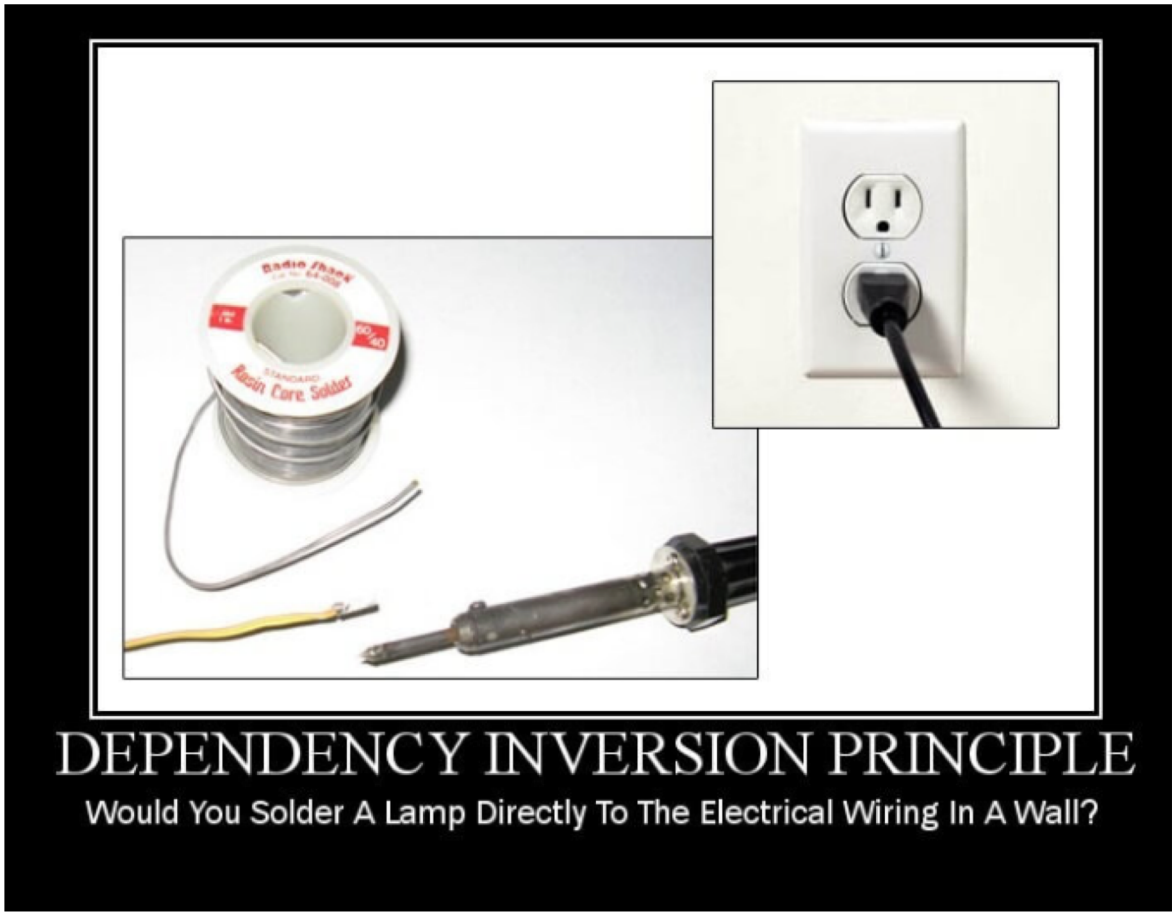
Interface Segregation principle

"Many client-specific interfaces are better than one general purpose interface"

```
interface ShapeInterface {
    public function area();
}

interface SolidShapeInterface {
    public function volume();
}

class Cuboid implements ShapeInterface, SolidShapeInterface {
    public function area() {
        // calculate the surface area of the cuboid
    }

    public function volume() {
        // calculate the volume of the cuboid
    }
}
```

Dependency Inversion principle

"Depend on abstractions, do not depend on concretions"



Dependency Inversion principle

"Depend on abstractions, do not depend on concretions"

```
public class Email
{
    public string ToAddress { get; set; }
    public string Subject { get; set; }
    public string Content { get; set; }
    public void SendEmail()
    {
        //Send email
    }
}
```

```
public class SMS
{
    public string PhoneNumber { get; set; }
    public string Message { get; set; }
    public void SendSMS()
    {
        //Send sms
    }
}
```

```
public class Notification
{
    private Email _email;
    private SMS _sms;
    public Notification()
    {
        _email = new Email();
        _sms = new SMS();
    }

    public void Send()
    {
        _email.SendEmail();
        _sms.SendSMS();
    }
}
```

Dependency Inversion principle

"Depend on abstractions, do not depend on concretions"

```
public interface IMessage
{
    void SendMessage();
}
```

```
public class Email : IMessage
{
    public string ToAddress { get; set; }
    public string Subject { get; set; }
    public string Content { get; set; }
    public void SendMessage()
    {
        //Send email
    }
}
```

```
public class SMS : IMessage
{
    public string PhoneNumber { get; set; }
    public string Message { get; set; }
    public void SendMessage()
    {
        //Send sms
    }
}
```

Dependency Inversion principle

"Depend on abstractions, do not depend on concretions"

```
public class Notification
{
    private ICollection<IMessage> _messages;

    public Notification(ICollection<IMessage> messages)
    {
        this._messages = messages;
    }
    public void Send()
    {
        foreach(var message in _messages)
        {
            message.SendMessage();
        }
    }
}
```

Referencias

- https://exceptionnotfound.net/tag/solid-principles/
- https://scotch.io/bar-talk/s-o-l-i-d-the-first-five-principles-of-object-oriented-design
- https://www.javacodegeeks.com/2011/11/solid-liskov-substitution-principle.html
- https://www.youtube.com/watch?v=TAVn7s-kO9o

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