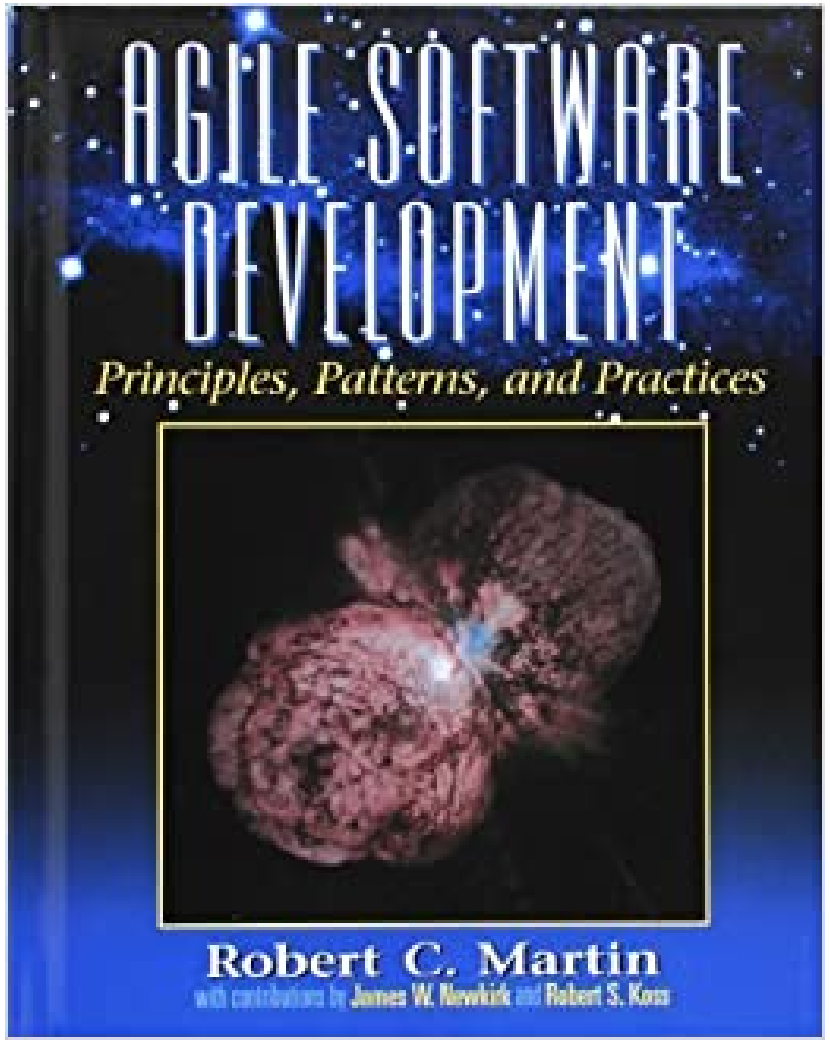
SOLID

Dependency Inversion Principle (DIP)

Dependency Inversion Principle

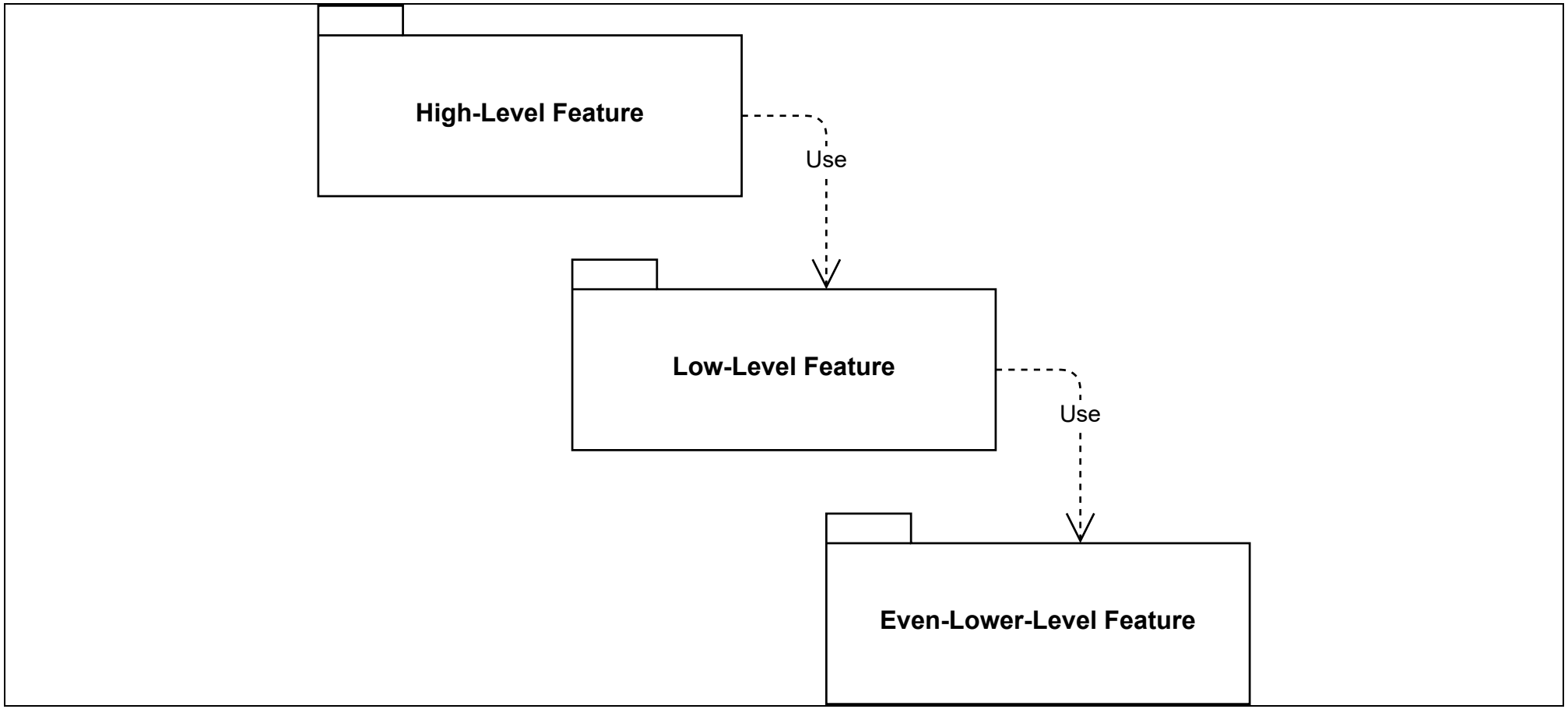
> ***"(a.) High-level modules shoud not depend on low-level modules. Both should depend on abstractions. (b.) Abstractions should not depend on details. Details should depend on abstractions."*** [Robert C. Martin]



Why?

- Increase of Maintainability
- Increase of Reusability
- Decrease of Rigidity

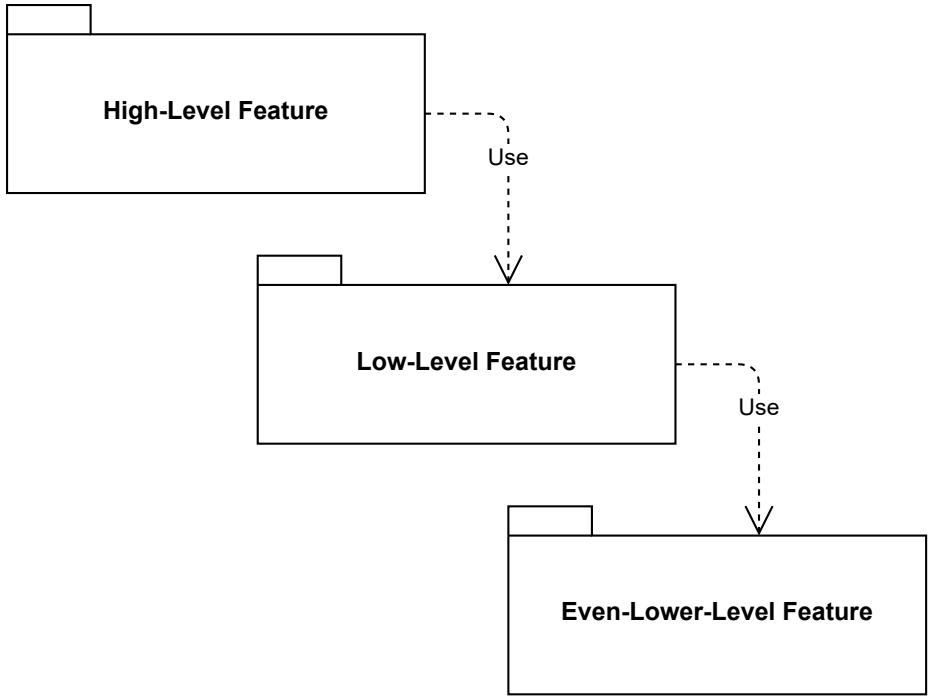
Procedural Program Design



Procedural Program Design

Program Design follows Call-Hierarchy:

- High-level features depend on low-level features
- Low-level features depend on even-lower-level features
- ...



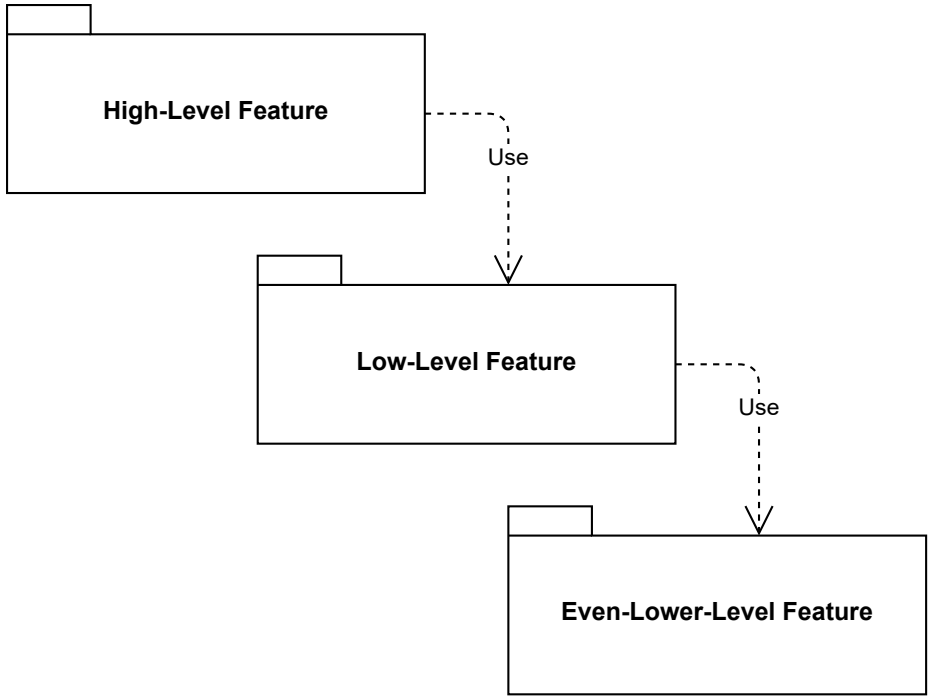
Procedural Program Design

Possible Risks:

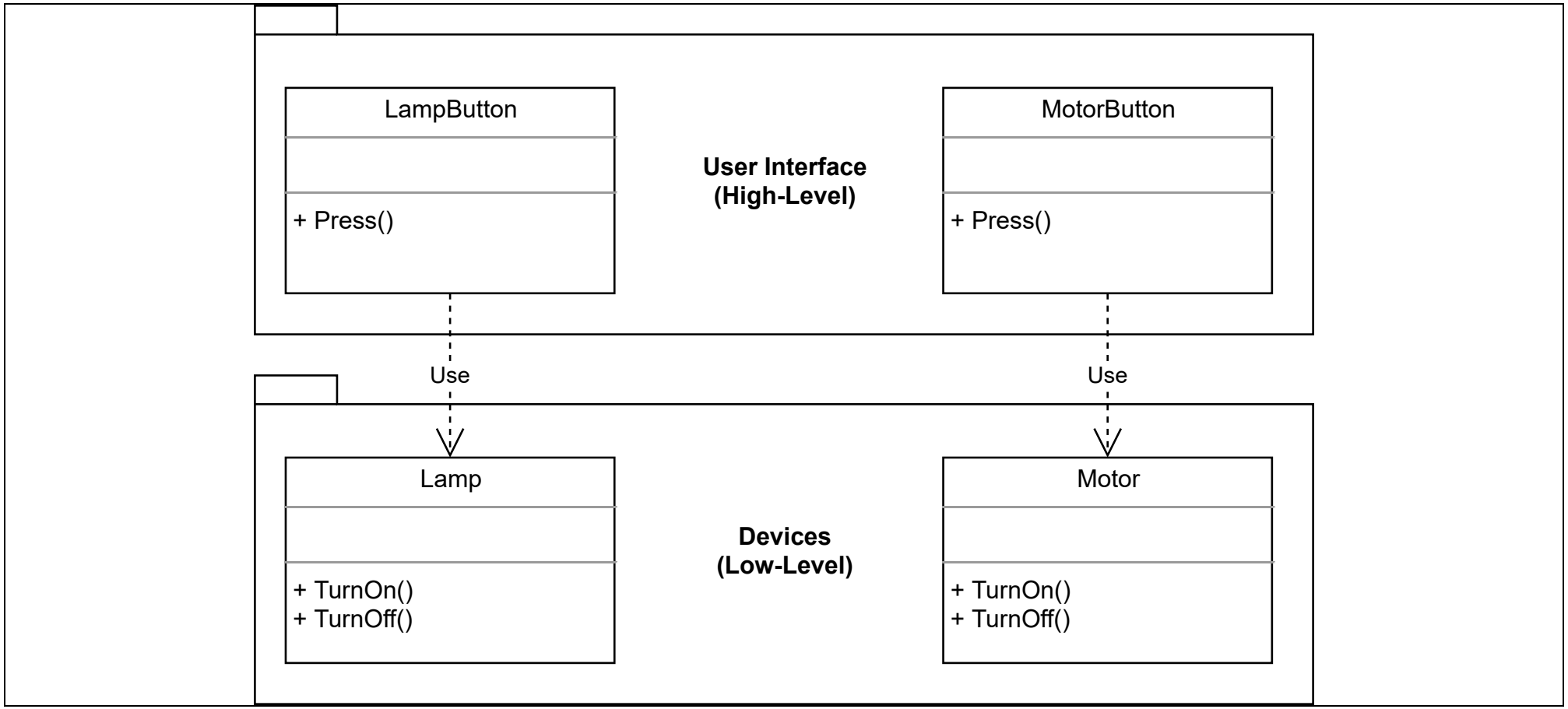
1. Changes on lower-level features are propaged to higher-level features

E.g. Adding a parameter to a lower-level method requires higher-level features to provide a suitable argument.

Also, reuse of higher-level features is impossible, because of *hard* dependencies.



Example without Dependency Inversion



Example without Dependency Inversion

Constraint A

> *"(a.) High-level modules shoud not depend on low-level modules. Both should depend on abstractions."* [Robert C. Martin]

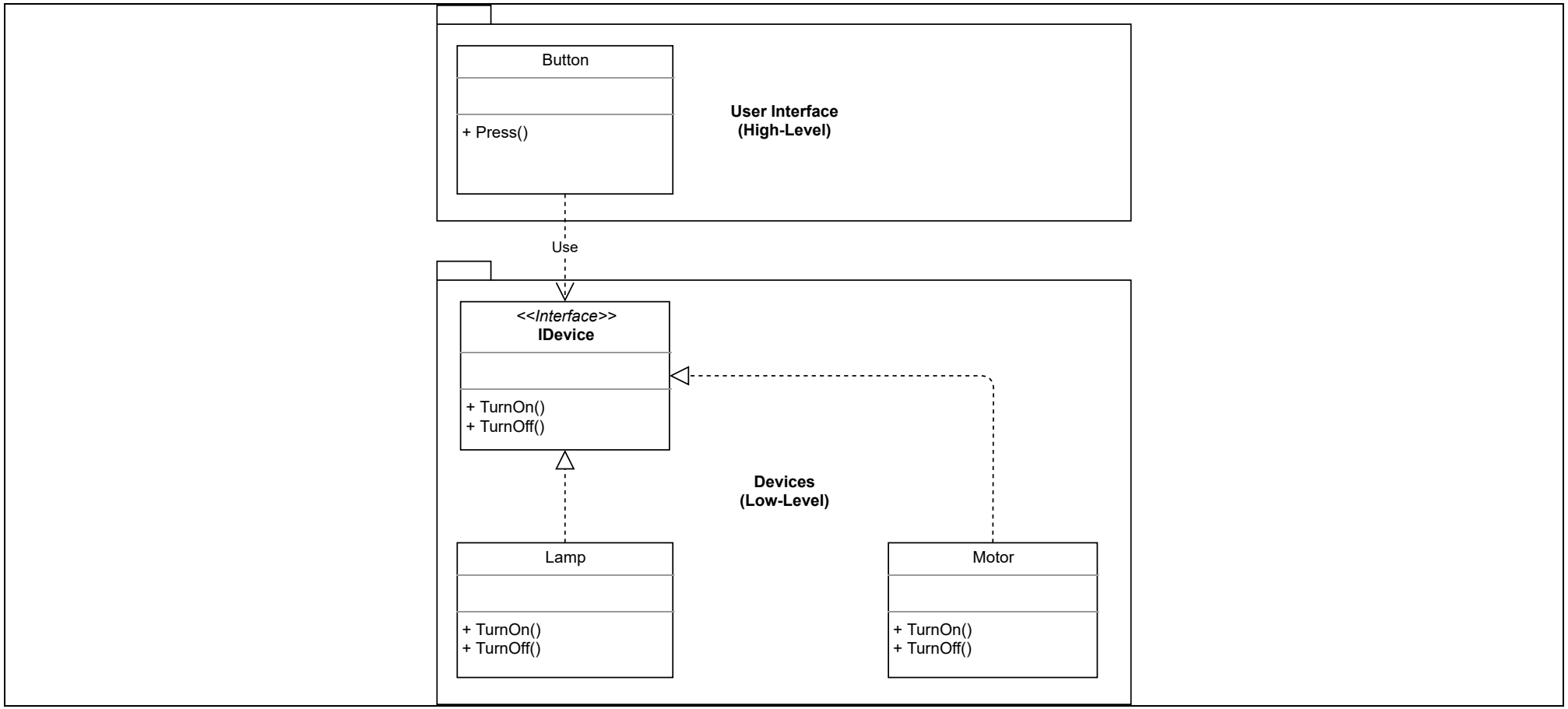
☒ **LampButton/MotorButton** (high-level) depends on **Lamp/Motor** (lovw-level). :-(
☒ No abstractions are present. :-(

Constraint B

> *"(b.) Abstractions should not depend on details. Details should depend on abstractions."* [Robert C. Martin]

☒ No abstractions are present. :-(

Example with *Naive* Dependency Inversion



Example with *Naive* Dependency Inversion

Constraint A

> *"(a.) High-level modules shoud not depend on low-level modules. Both should depend on abstractions."* [Robert C. Martin]

☒ **UI/Button** (high-level) depends on **Devices/IDevice** (lovw-level). :-(
☑ **UI/Button** and **Devices/Lamp/Motor** depend on **Devices/IDevice** (abstraction). :-)

Constraint B

> *"(b.) Abstractions should not depend on details. Details should depend on abstractions."* [Robert C. Martin]

☒ **UI/Button** (abstraction) depends on **Devices/IDevice** (details). :-(
☒ **Devices** (details) does not depend on **UI** (abstraction). :-(

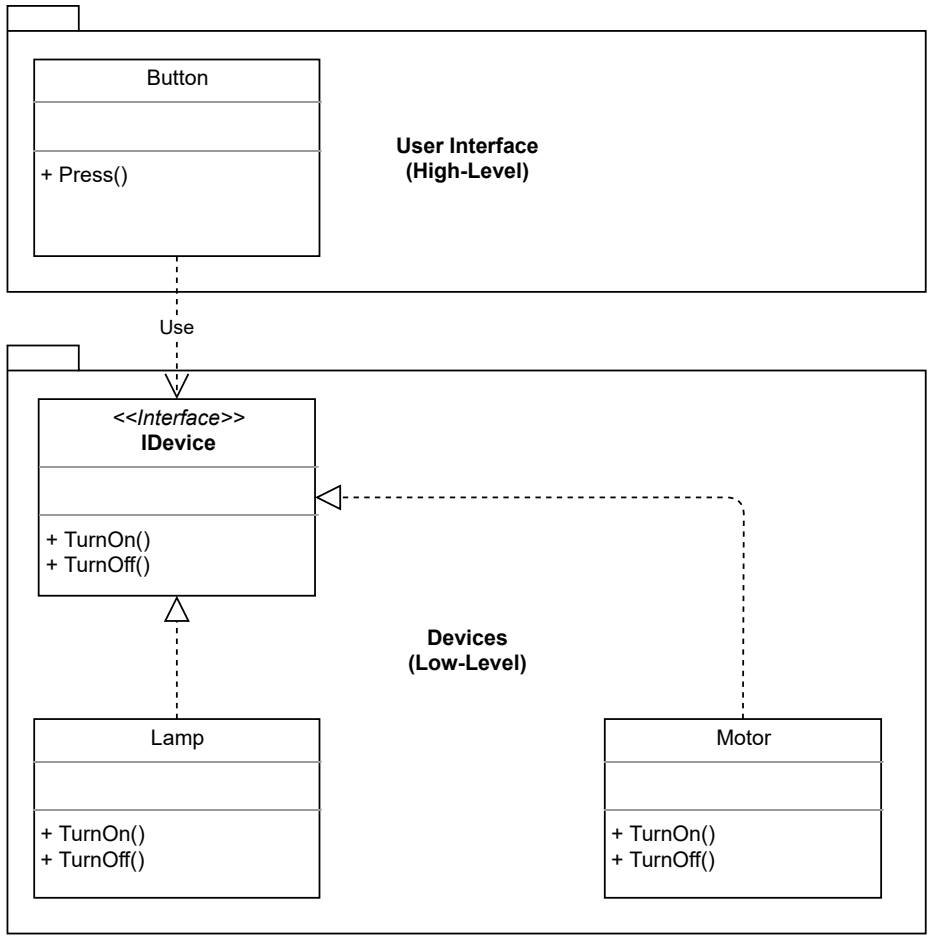
Example with *Naive* Dependency Inversion

Why is it *Naive*?

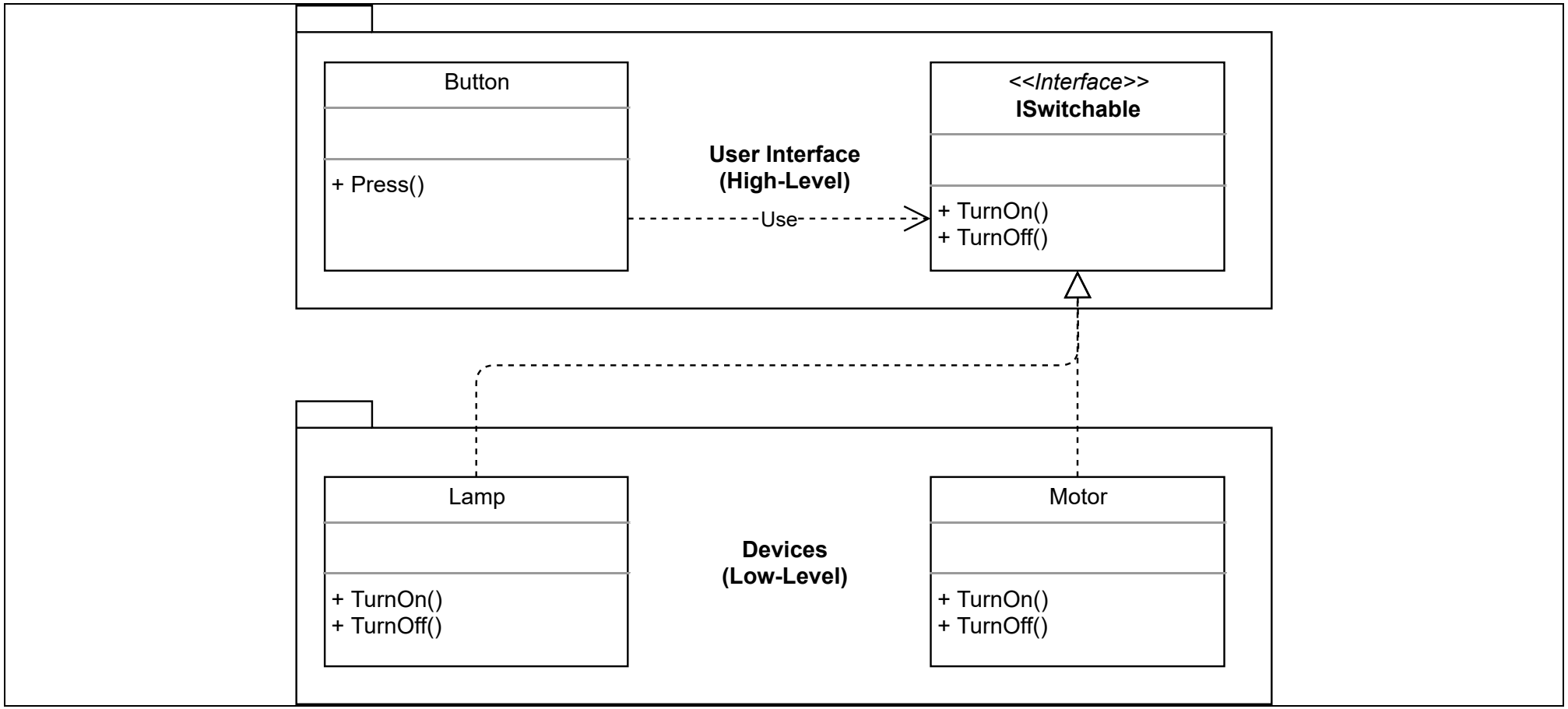
- **Package dependency is not inverted.**

Changes can still propagate from lower-level features to higher-level features.

The client of the interface does not "own" it. This still allows changes to originate in lower-level features when changes are triggred bottom-up, i.e. not triggred by usages.



Example with Dependency Inversion



Example with Dependency Inversion

Constraint A

> *"(a.) High-level modules shoud not depend on low-level modules. Both should depend on abstractions."* [Robert C. Martin]

☑ **UI/Button** (high-level) does not depend **Devices/Lamp/Motor** (lovw-level). :-)
☑ **UI/Button** and **Devices/Lamp/Motor** depend on **UI/ISwitchable** (abstraction). :-)

Constraint B

> *"(b.) Abstractions should not depend on details. Details should depend on abstractions."* [Robert C. Martin]

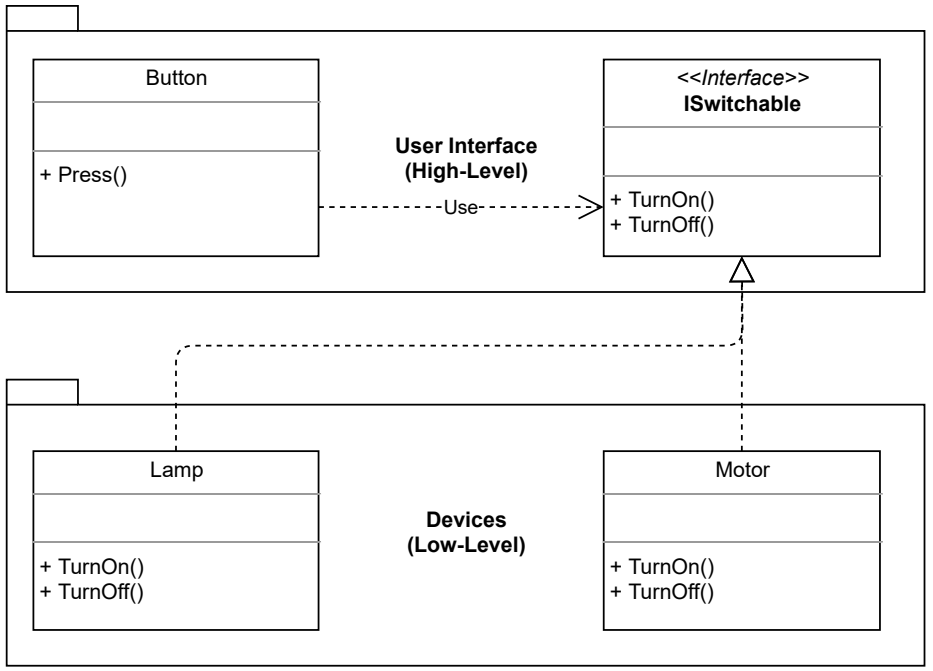
☑ **UI/Button** (abstraction) does not depend on **Devices/Lamp/Motor** (details). :-)
☑ **Devices/Lamp/Motor** (details) depends on **UI/ISwitchable** (abstraction). :-)

Example with Dependency Inversion

Package Dependency is inverted!

Low-level devices must do some work in order to work with the high-level UI feature.

High-level features like Button can be reused.



Where is the Inversion?

Without DIP: UI *using* Devices

```
using Devices;

class LampButton
{
  private Lamp _lamp;
  public void Press() { _lamp.TurnOn(); }
}

class MotorButton : ISwitchable
{
  private Motor _motor;
  public void Press() { _motor.TurnOn(); }
}
```

```
class Lamp { ... }

class Motor { ... }
```

Where is the Inversion?

With Naive DIP: UI still *using* Devices

```
using Devices;

class Button
{
  private IDevice _device;
  public void Press() { _device.TurnOn(); }
}
```

```
interface IDevice { ... }

class Lamp : IDevice { ... }

class Motor : IDevice { ... }
```

Where is the Inversion?

With DIP: Devices *using* UI

```
interface ISwitchable { ... }

class Button
{
  private ISwitchable _switchable;
  public void Press() { _switchable.TurnOn(); }
}
```

```
using UI;

class Lamp : ISwitchable { ... }

class Motor : ISwitchable { ... }
```

Dependency Inversion

Don't call us, we'll call you!

Why does nobody mention Dependency Injection?

Because it has **nothing** to do with Dependency *Inversion*!

- Dependency **Inversion**
  is about module/package/class design
- Dependency **Injection**
  is about instantiating classes

Thanks!