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Software Engineering Design & Construction

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Dependency-Inversion Principle

D*ependency-****I****nversion* ***P****rinciple*

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

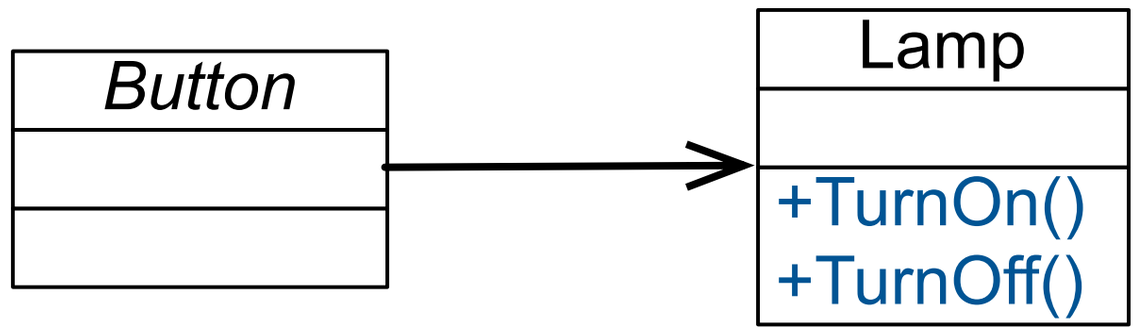
Abstractions should not depend on details. Details should depend on abstractions.

–Agile Software Development; Robert C. Martin; Prentice Hall, 2003

Introduction by Example

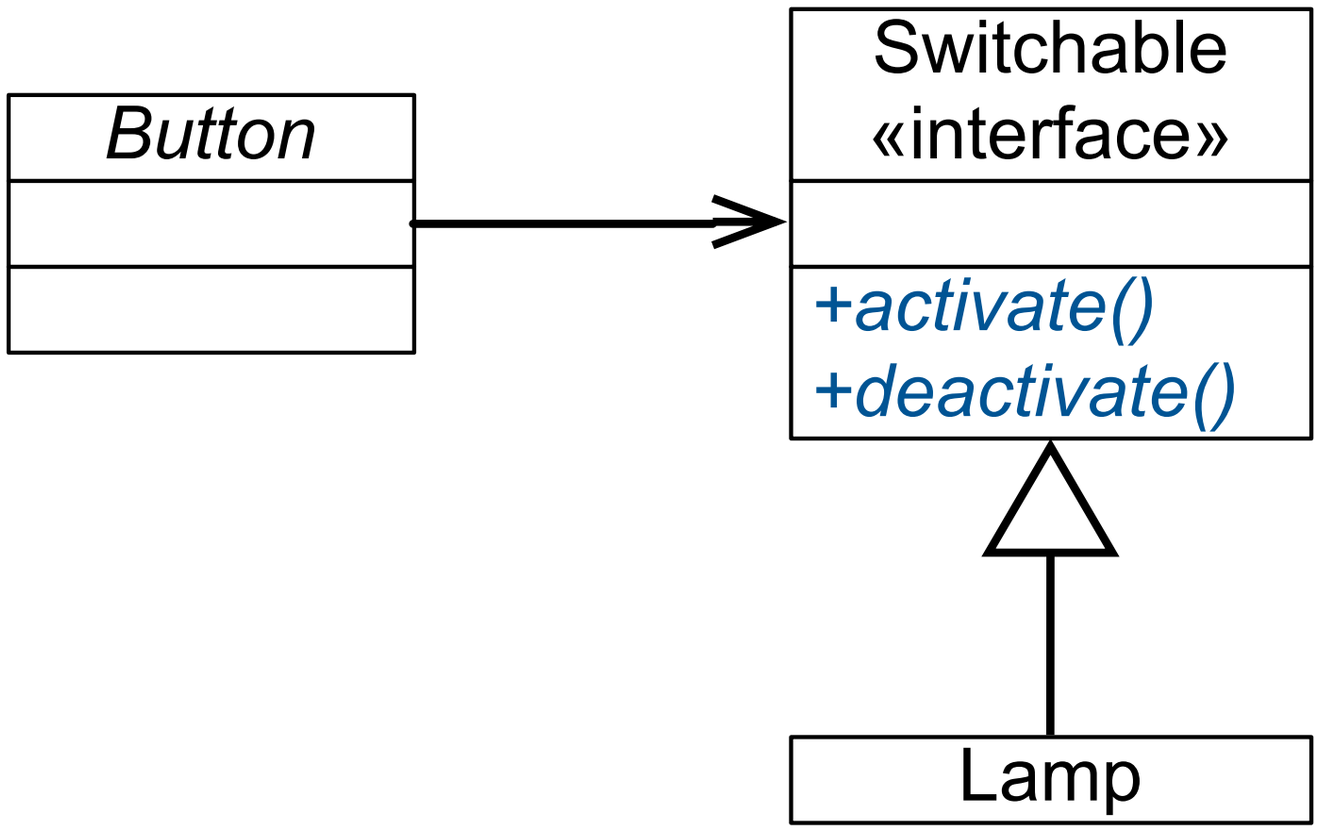
A Small Design Exercise

- Behavior of `Button`:
  - The button is capable of "sensing" whether it has been activated/ deactivated by the user.
  - Once a change is detected, it turns the Lamp on, respectively off.



Issues?

A Dependency-Inversion Principle Compliant Solution



The Rationale behind the Dependency-Inversion Principle

- Good software designs are structured into modules.
  - **High-level modules** contain the important policy decisions and business models of an application – The identity of the application.
  - **Low-level modules** contain detailed implementations of individual mechanisms needed to realize the policy.

The Rationale behind the Dependency-Inversion Principle

- Good software designs are structured into m
  - High-level m
    - ...individual mechanisms needed to realize the policy.

High-level Policy
The abstraction that underlies the application; the truth that does not vary when details are changed; the system inside the system; the metaphor.

„…all well-structured object-oriented architectures ***have clearly defined layers****, with each layer providing some coherent set of services* ***through a well-defined and controlled interface…****“*

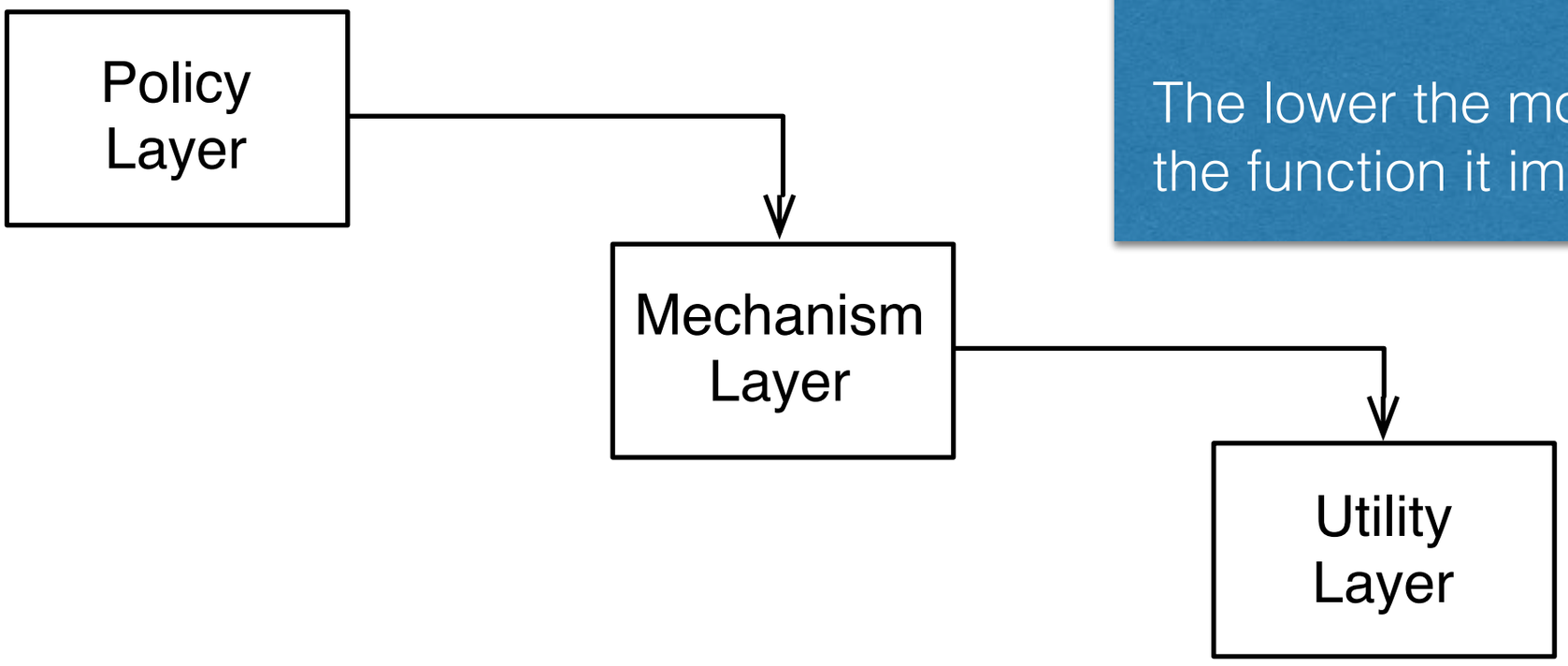
-Grady Booch

„…all well-structured object-oriented architectures ***have clearly defined layers****, with each layer providing some coherent set of services* ***through a well-defined and controlled interface…****“*

An Interpretation

The higher the module is positioned in a layered architecture, the more general the function it implements.

The lower the module, the more detailed the function it implements.



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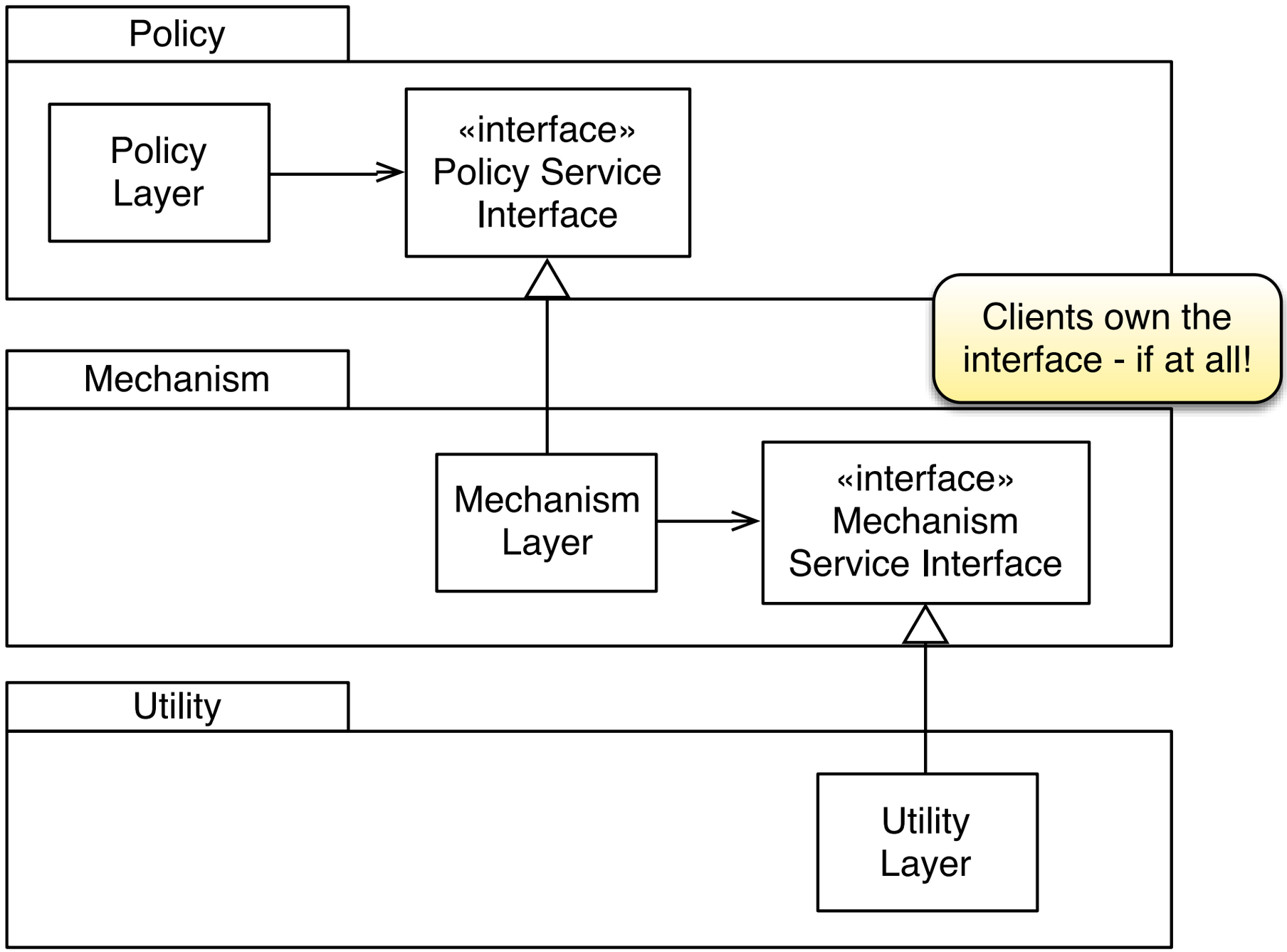
Layers and Dependencies

Inverted Layer Dependencies



Naïve Heuristic for Ensuring DIP

DO NOT DEPEND ON A CONCRETE CLASS.

All relationships in a program should terminate on an abstract class or an interface.

- No class should hold a reference to a concrete class.
- No class should derive from a concrete class.
- No method should override an implemented method of any of its base classes.

D*ependency-****I****nversion* ***P****rinciple*

- Traditional structural programming creates a dependency structure in which policies depend on details.
  (Policies become vulnerable to changes in the details.)

- Object-orientation enables to invert the dependency:

- Policy and details depend on abstractions.

- Service interfaces are owned by their clients.

- Inversion of dependency is the hallmark of good object-oriented design.
  (Implies an inversion of interface ownership.)

Which kind of refactoring is strongly related to the DIP?