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Software Engineering Design & Construction

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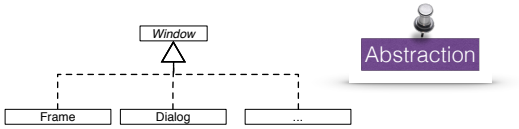
Bridge Pattern

The Bridge Design Pattern

Decouple an **abstraction** from its **implementation**.
So that the two can vary independently.

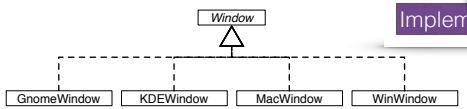
Motivation by Example

We want to provide different types of windows:



Abstraction

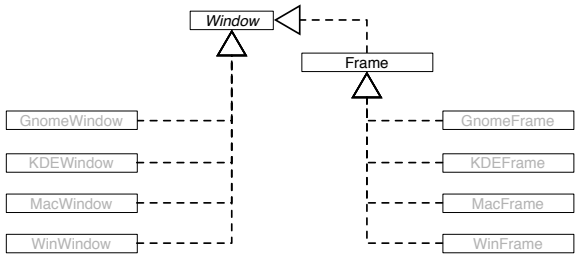
We want to support multiple operating systems:



Implementation

Motivation by Example

Two dimensions of variability!

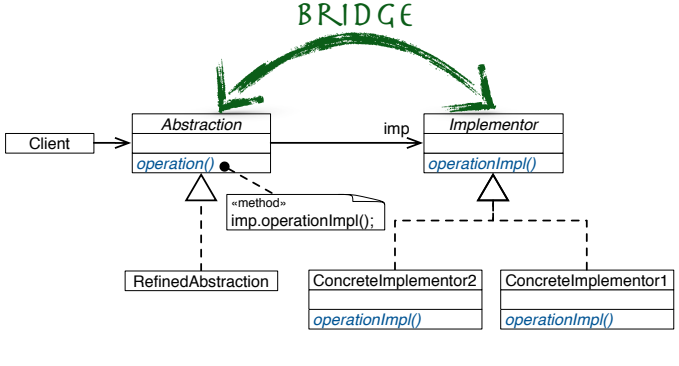


Can you imagine a better solution?

Several problems:

- Implementation bound to abstraction
- Code duplication and proliferation of classes

Bridge Design Pattern - Structure

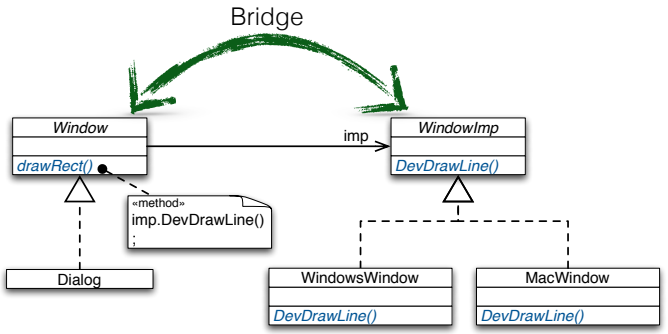


Combine inheritance and object composition.

Combine inheritance and object composition:

- Use inheritance to model variations of the abstraction.
- Use object composition to abstract from implementation variations.

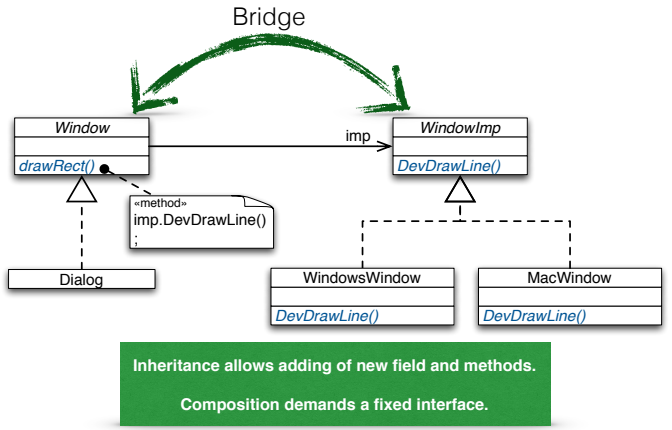
Bridge Design Pattern - Illustrated



The Rationale Underlying the Solution:

- Object composition and inheritance provide different trade-offs for expressing variations.
- Object composition is used to implement dynamic variations with a fixed interface.
- Implementation variations are more of this kind; although not always…
- For static variations inheritance is preferred, because it supports structural variations.
- Abstraction variations are mostly static.
- They often imply variation of structure.

Bridge Design Pattern - Illustrated



Advantages

Decoupling interface and implementation:

- Implementation can be configured at run-time.
- The implementation in use is hidden inside the abstraction.

Improved extensibility:

- Both abstractions and their implementations become independently extensible by subclassing without a class proliferation.
- Different abstractions and implementations can be combined.

Takeaway

- The Bridge Pattern instructs to use object composition to bridge between two inheritance hierarchies when you need to combine two kinds of variations of an object type.
- The Bridge Pattern allows to vary an abstraction and its implementation independently of each other.
- Works well as long as there is no dependency between the implementation on abstraction variations, i.e., if they do not vary co-variantly.