



Design Patterns Not Just for Architects

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What Are Design Patterns?

“Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to the problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice.”

-- Christopher Alexander

The Gang Of Four (GoF)

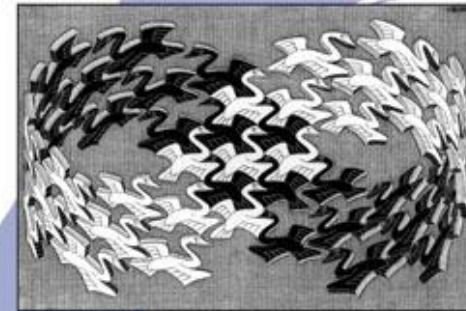
Design Patterns:
Elements of Reusable
Object-Oriented Software

- Erich Gamma
- Richard Helm
- Ralph Johnson
- John Vlissides

Design Patterns

Elements of Reusable
Object-Oriented Software

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Foreword by Grady Booch



Anatomy Of A Design Pattern

- Pattern Name
 - A unique way of referring to the pattern
- Problem
 - The problem that occurs “over and over again”
- Solution
 - The “core” of the solution
- Consequences
 - The drawbacks or considerations when using the pattern

Creational Patterns

Abstract Factory
Builder
Factory Method
Prototype
Singleton

Structural Patterns

Adapter
Bridge
Composite

Decorator
Facade
Flyweight
Proxy

Chain of Responsibility
Command
Interpreter
Iterator

Behavioral Patterns

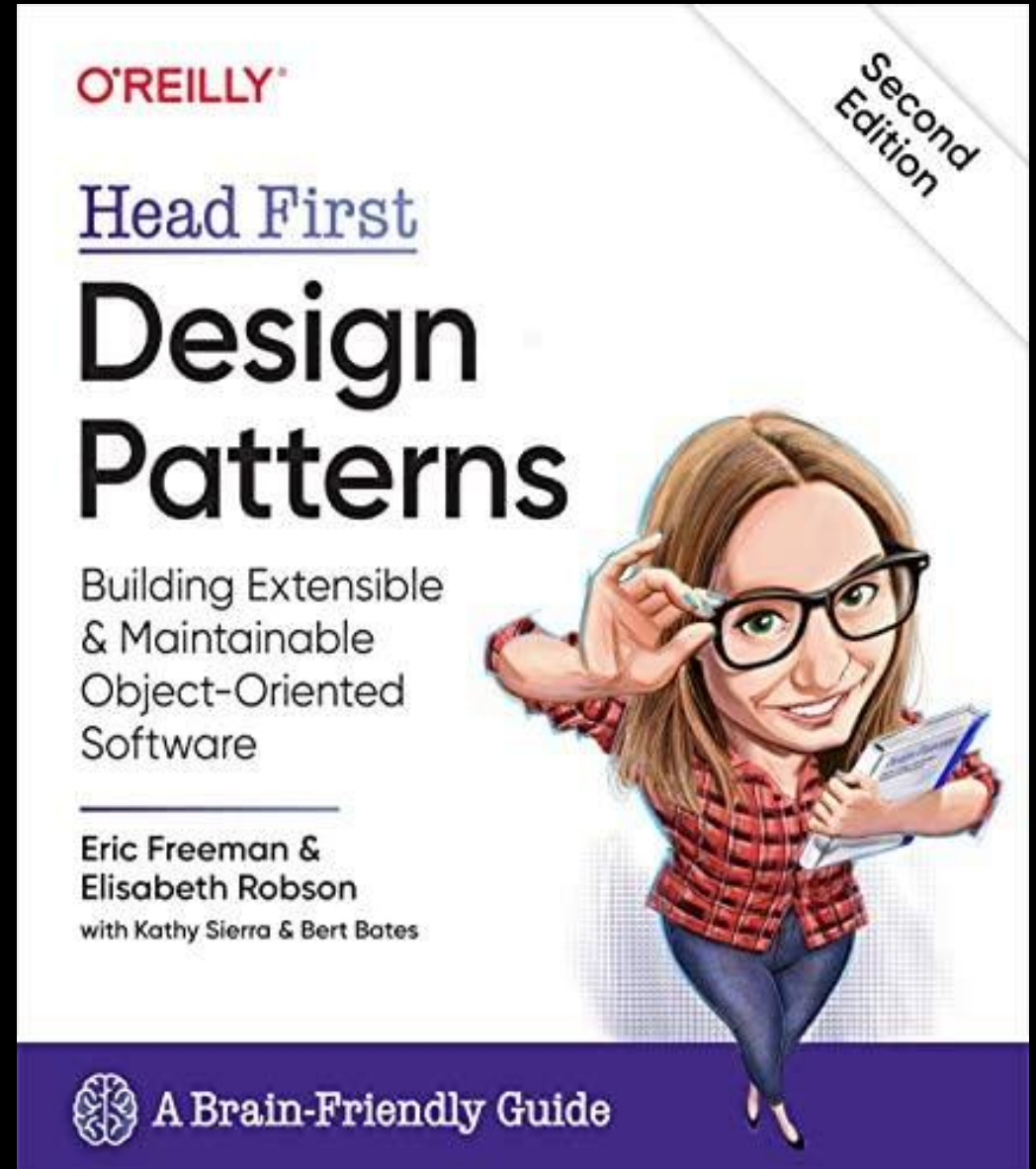
Mediator
Memento
Observer
State
Strategy
Template Method
Visitor

The GoF Patterns

A More Approachable Reference

- Head First Design Patterns (Second Edition)
 - Eric Freeman
 - Elisabeth Robson

Covers 12 GoF Patterns





Why Should We Care?

You already use them!

- Well described solutions
- Shared vocabulary
- Concise language
- Think in design rather than implementation
- Encourage other developers to learn patterns



Observer

GoF Description:

“Define a one-to-many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically.”

Real World Observer

- Podcasts

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CrowdStrike: Terrible name, terrible outage CrowdStrike, a company no one has ever heard of, ships an update that borks Windows PCs, servers, and clouds services at the heart of the world's infrastructure. Naturally, everyone blamed Microsoft at first Microsoft says outage impacted under 1 percent of PCs. It was

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Observer Implementations (in .NET)

- Event Handler
 - Built in to .NET
- Event Aggregator
 - Go-between for observers and subject
- `IObserver<T>` / `IObservable<T>`
 - Observable: `Subscribe`
 - Observer: `OnNext`, `OnCompleted`, `OnError`
- Many others...



Observer Consequences

- We don't know how many times we will be notified. It could be 1 or it could be 100,000.
- We don't know how frequently we will be notified. It could be once per day or 100 times per ms.
- We don't know if we will be notified at all.

Wrong Way to Use Patterns

**“Observer is awesome!
I’m going to use it as much as possible.”**

- Not every tool is the right tool for the job.
- The wrong tool adds unneeded complexity.
- The wrong tool only gives you consequences (no benefits).

Right Way to Use Patterns

**“I need to be notified when
something has changed.
Is there a pattern that addresses that?”**

- Identify the problem first.
- See if there is a pattern that solves that problem.
- Get the benefits.



Iterator

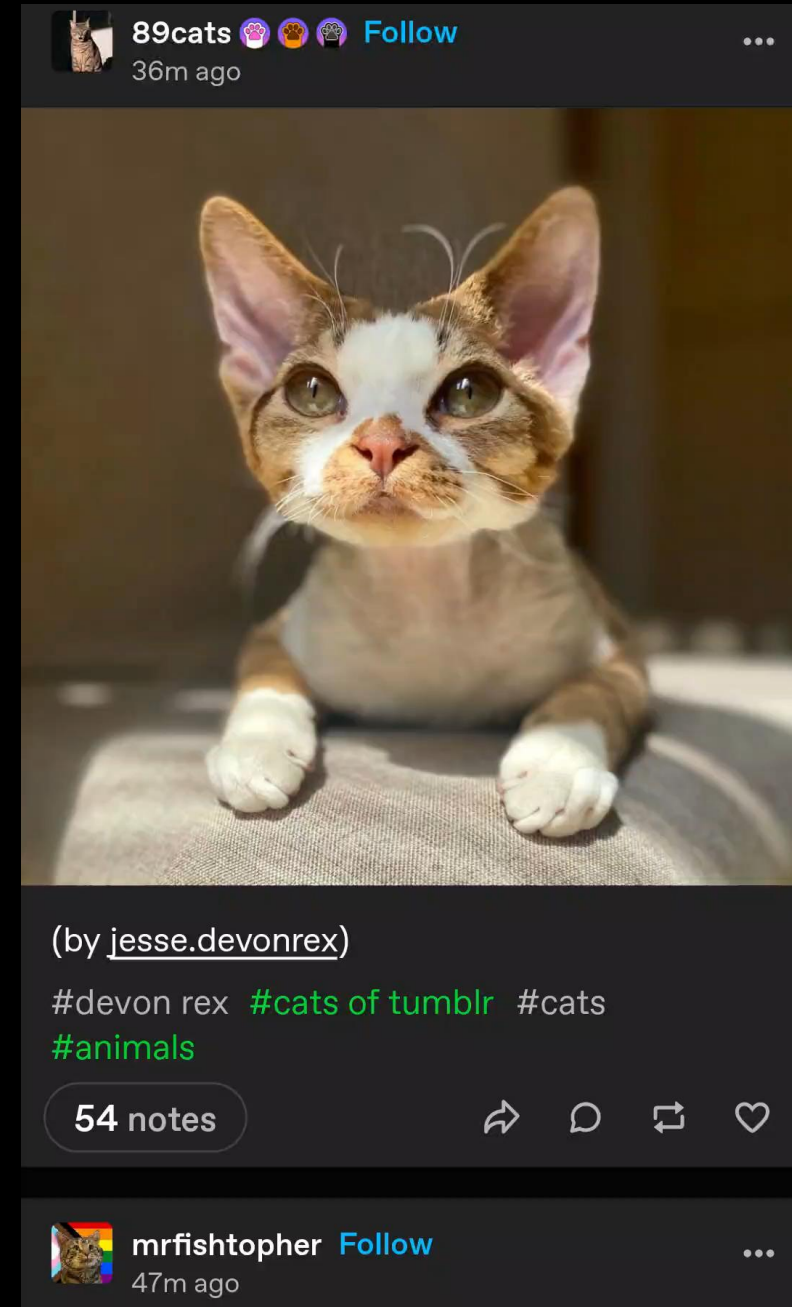
GoF Description:

“Provide a way to access the elements of an aggregate object sequentially without exposing its underlying representation.”

Real World Iterator

- Social Media

@jeremybytes



Iterator Implementations (in .NET)

- List<T>
 - List has an iterator built in.
- IEnumerable<T>
 - An interface with methods to build my own iterator.
- Many others...

Interesting Side Note:

The GoF book has an appendix with an iterator implementation

Iterator Consequences

- Adding or removing items during iteration can invalidate the iterator.
- Multiple iterators can work on a single object.



Facade

GoF Description:

“Provide a unified interface to a set of interfaces in a subsystem. Facade defines a higher-level interface that makes the subsystem easier to use.”

Real World Facade



- Play Blu-ray
 - Turn on TV
 - Set TV to Blu-ray player
 - Turn on sound bar
 - Set sound bar to digital in
 - Turn on Blu-ray player
 - “Play” on Blu-ray player



Where I Used a Facade

[https://reportingServer/RunReport?id=3D2B4067-DBEE-4B3C-A5D7-DC9011300775
&user-id=24¶m1=20250331¶m2=20250406&output=pdf](https://reportingServer/RunReport?id=3D2B4067-DBEE-4B3C-A5D7-DC9011300775&user-id=24¶m1=20250331¶m2=20250406&output=pdf)

```
var report = new WebReport();  
report.Application = "Facilities";  
report.ReportName = "WeeklyMaintenance";  
report.UserName = userName;  
report.Params.AddDate(2024, 03, 31);  
report.Params.AddDate(2024, 04, 06);  
report.Output = ReportOutput.PDF;  
return report.RunReport();
```

Facade Consequences

- If functionality is added to the sub-system, we may need to change the facade as well.
- Not all functionality of the sub-system may be available. The available functions in the facade are probably limited.



Chain Of Responsibility

GoF Description:

“Avoid coupling the sender of a request to its receiver by giving more than one object a chance to handle the request. Chain the receiving objects and pass the request along the chain until an object handles it.”

Real World Chain Of Responsibility

- Tech Support



Chain of Responsibility Consequences

- If none of the receivers handle the message, then the message will fall off the end of the chain.



Proxy

GoF Description:

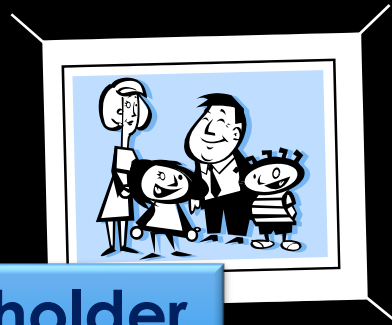
“Provide a surrogate or placeholder for another object to control access to it.”

Real World Proxy

- Power of Attorney



Interesting History



Placeholder



Original

Proxy Consequences

- A remote proxy can hide the fact that the object resides in a different process or across a network.
- The proxy must be kept synchronized with the real object.



A Million Implementations

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-- Christopher Alexander



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Thank You!

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<https://github.com/jeremybytes/learning-design-patterns>