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Intensive S.O.L.I.D.

Jason Gorman

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Today…

- Before We Begin - Refactoring Foundations
- Goals of OO Design
- Dependencies
  - Efferent & Afferent Couplings
  - Dependency Analysis
  - 4 Rules of Dependency Management
- Basic Design Principles
  - Simple Design
  - Don't Repeat Yourself
  - Tell, Don't Ask
- Class Design Principles
  - Single Responsibility
  - Open-Closed
  - Liskov Substitution
  - Interface Segregation
  - Dependency Inversion
- Complimentary Design Principles
  - Law of Demeter

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Before We Begin…

REFACTORING FOUNDATIONS

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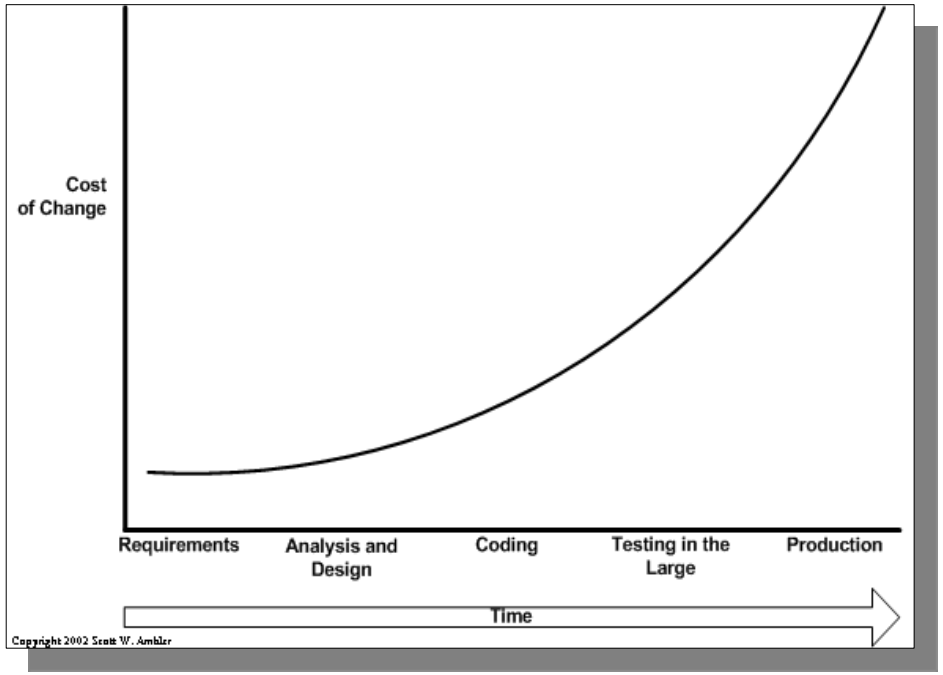
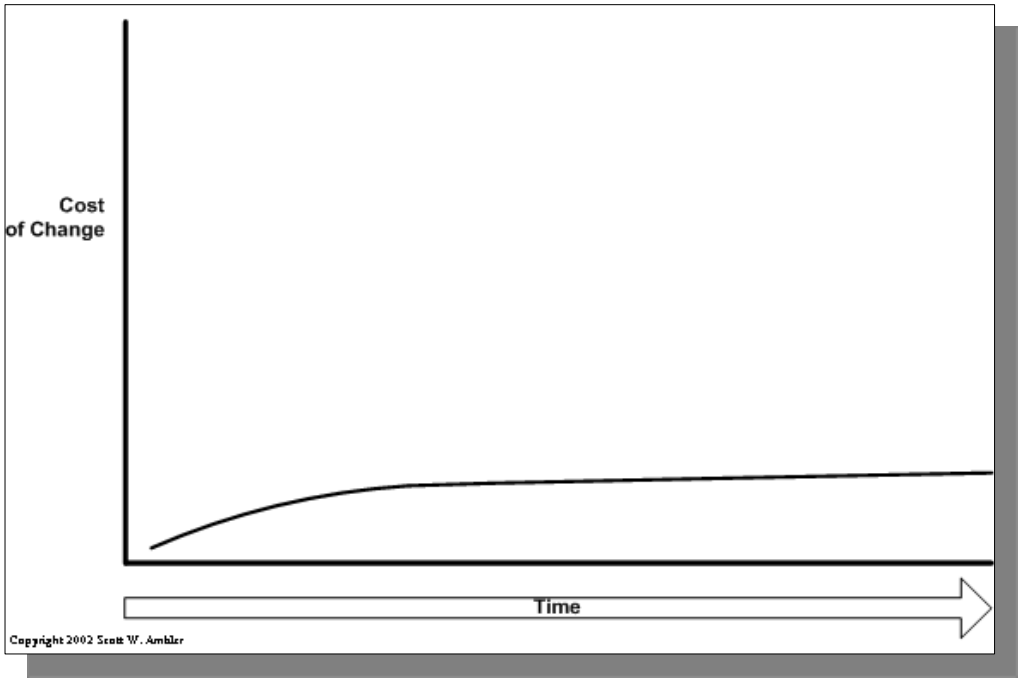
Cost Of Change



Source:Scott W. Ambler, agilemodeling.com



Source: Kent Beck, Extreme Programming Explained

What Makes Code Harder To Change?

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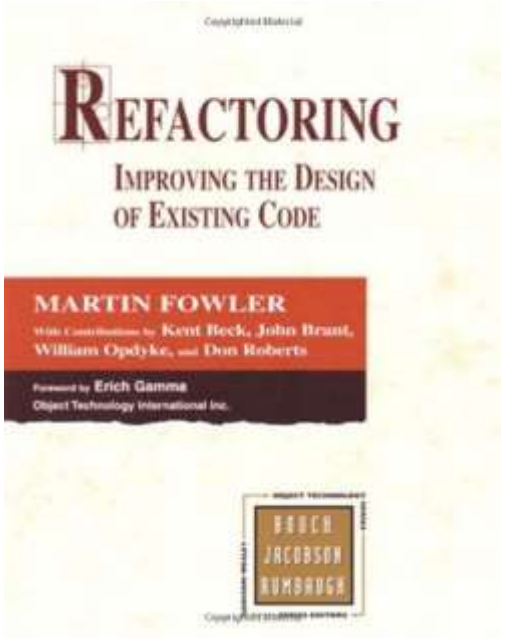
Readability

Complexity

Duplication

Dependencies & The “Ripple Effect”

Refactoring is…



…improving the design of existing code
without changing what it does

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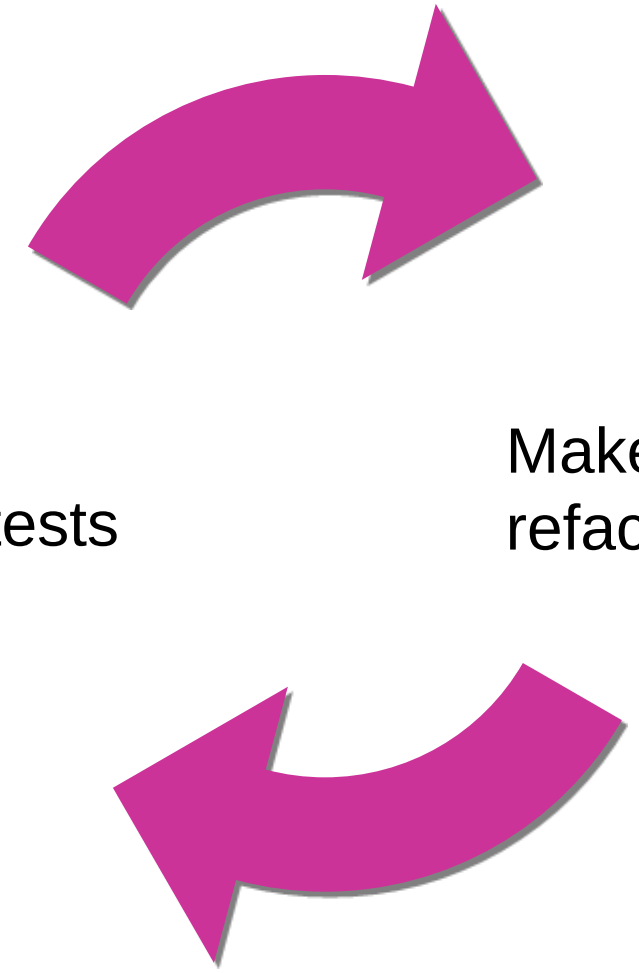
Refactoring Process



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Code Smells

…are indications of *increasing entropy* in your code

- Increasing complexity
- Increasing duplication
- Increasing dependency issues
- Decreasing comprehensibility

- As time goes on, code can become *rigid* and *brittle*

Classes Of Code Smell

Complexity	Responsibility Problems	Couplers
•**Long Method** •**Large Class** •Primative Obsession •**Data Clumps** •**Long Parameter Lists**	•**Divergent Change** •Shotgun Surgery •**Data Class**	•**Feature Envy** •**Message Chains** •**Inappropriate Intimacy** •Middle Man

OO Abuses	Redundancy
•**Switch Statements** •Temporary Field •Refused Bequest •Alternative Classes With Different Interfaces •Parallel Inheritance Heirarchies	•Lazy Class •**Duplicate Code** •Dead Code •Speculative Generality

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Long Methods

Extract Method

Decompose Conditional

Duplicate Code (Simple)

Extract Method

Extract Class

Good Refactoring Habits

- Run the tests after every refactoring
- If refactoring fails, undo/roll back
- Identify code smells and use appropriate refactorings
- Refactor directly to well-defined goals
- Check-in after every refactoring goal is met
- Never refactor on a red light
- Use automated refactorings whenever possible
- Do one refactoring at a time

Then let’s begin…

OBJECT ORIENTED DESIGN PRINCIPLES

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http://www.codemanship.co.uk/files/solid.zip

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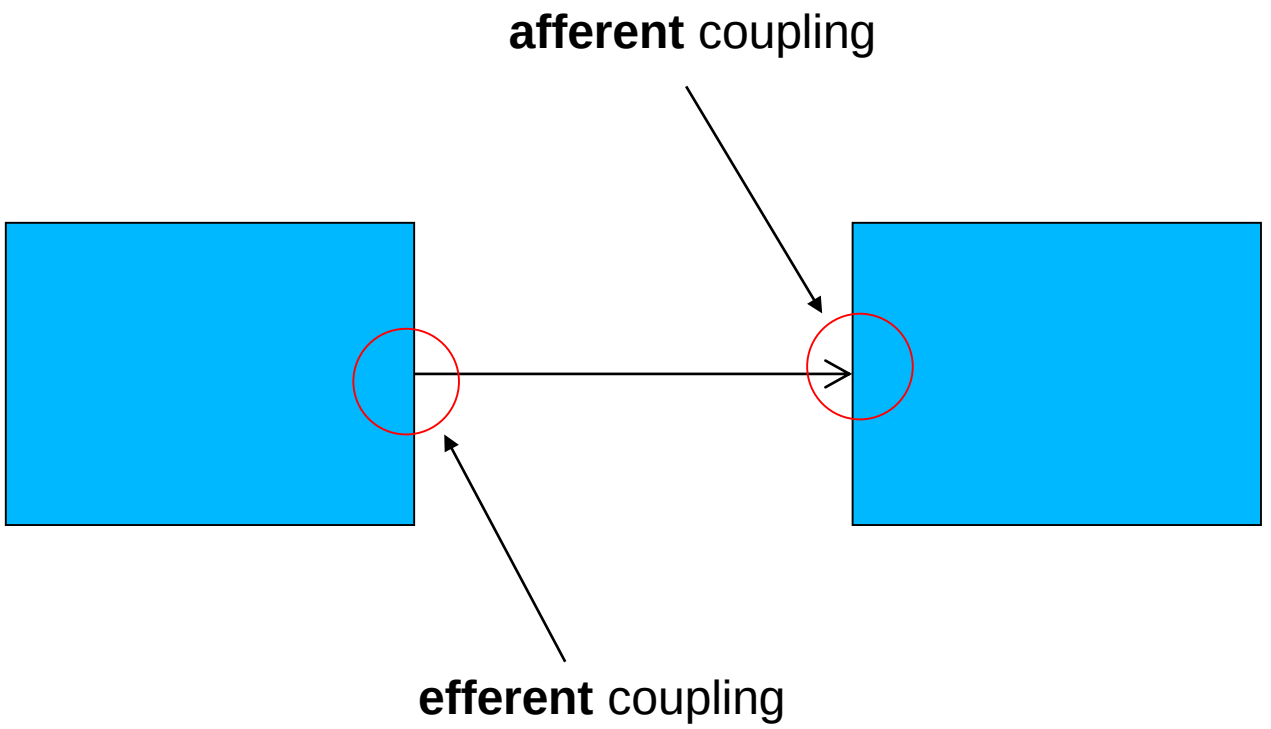
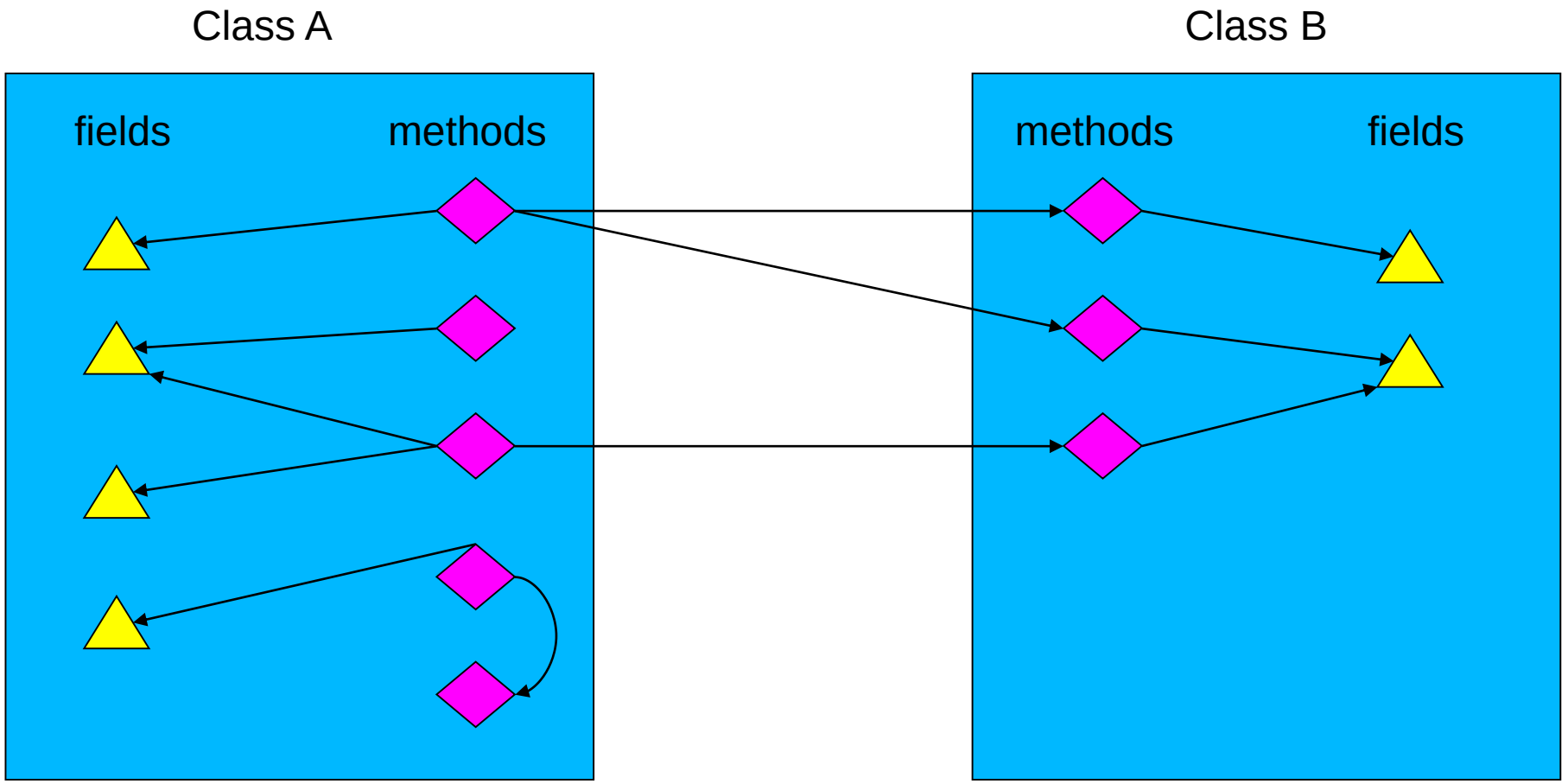
Goals Of OO Design

By packaging data, function and interfaces together, what do we hope to achieve?

Dependencies



Dependency Analysis



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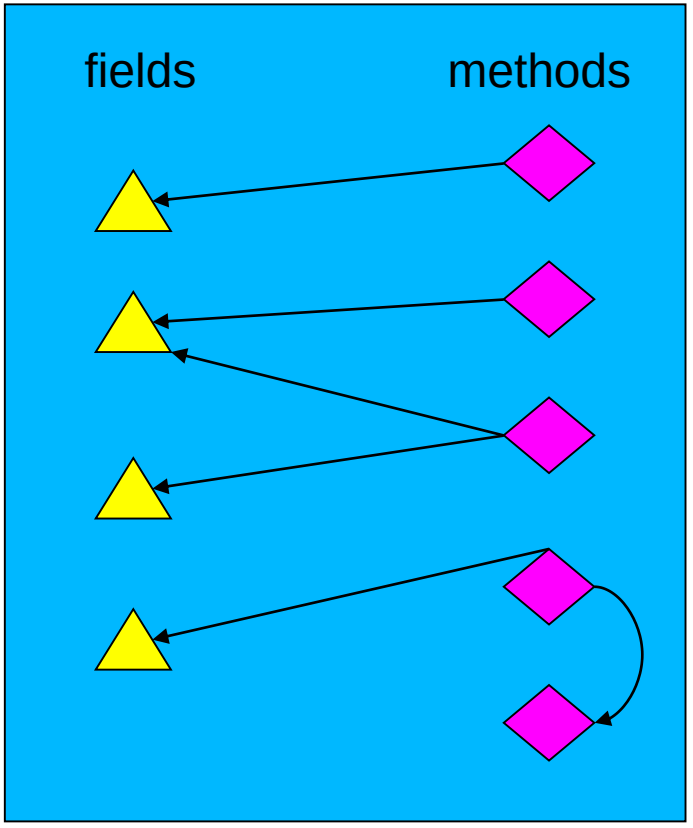
Class Cohesion



No. of internal relationships = 6

No. of methods* = 5

Average relationships per method = 1.2

** Including explicitly-declared and implied constructors*

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Jason's 4 Rules Of Dependency Management

1. **Minimise** dependencies
    - Introduce less dependencies overall
2. **Localise** dependencies
    - Package dependent things together (methods, fields, classes)
3. **Stabilise** dependencies
    - Depend on things that are less likely to change
4. **Abstract** dependencies
    - Depend on things that are easier to substitute

Basic Design Principles

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Simple Design

Less Code means Less Dependencies

Don’t Repeat Yourself

Duplicated Code means Duplicated Dependencies

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Tell, Don’t Ask

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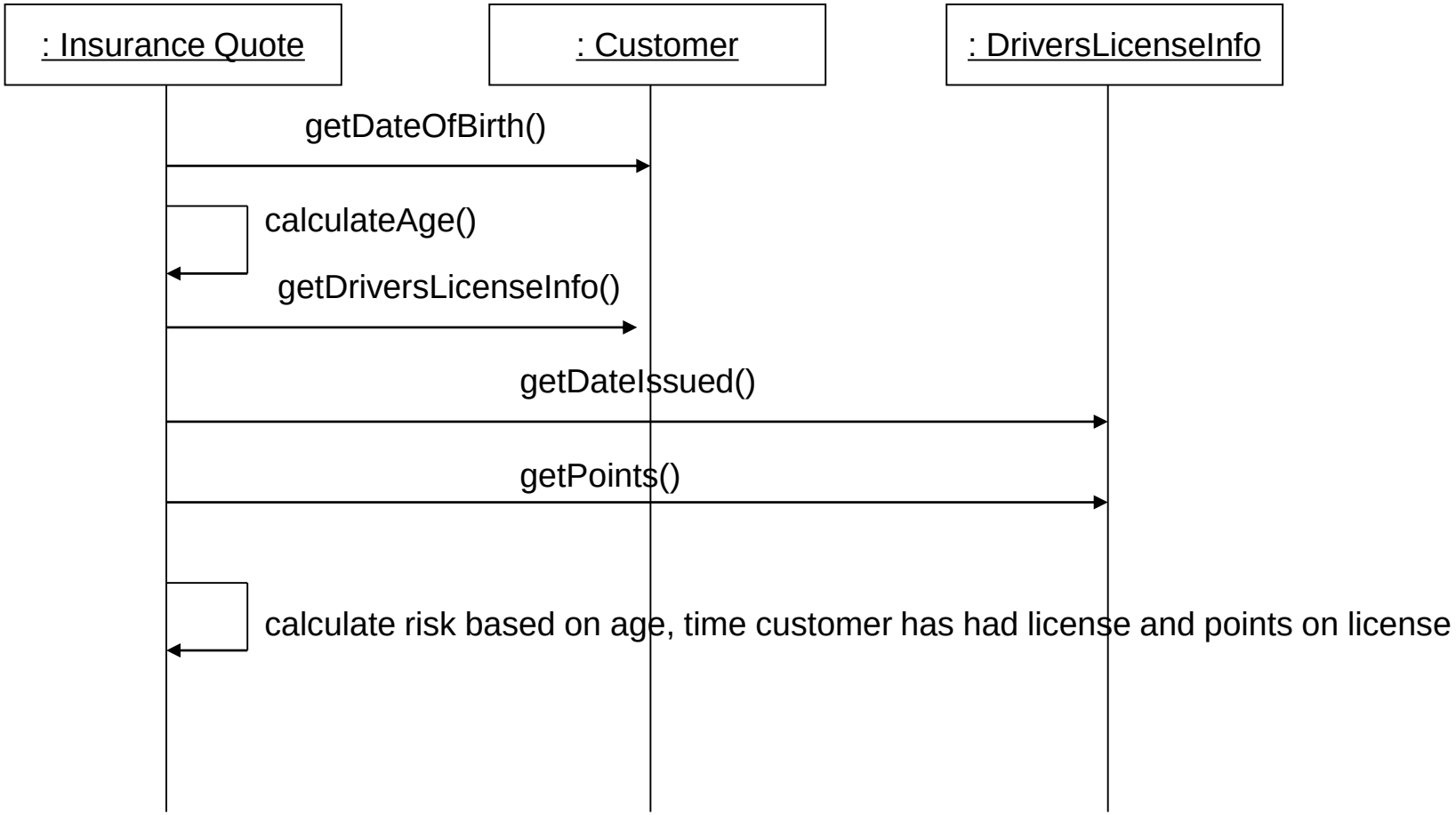
Data-driven Design



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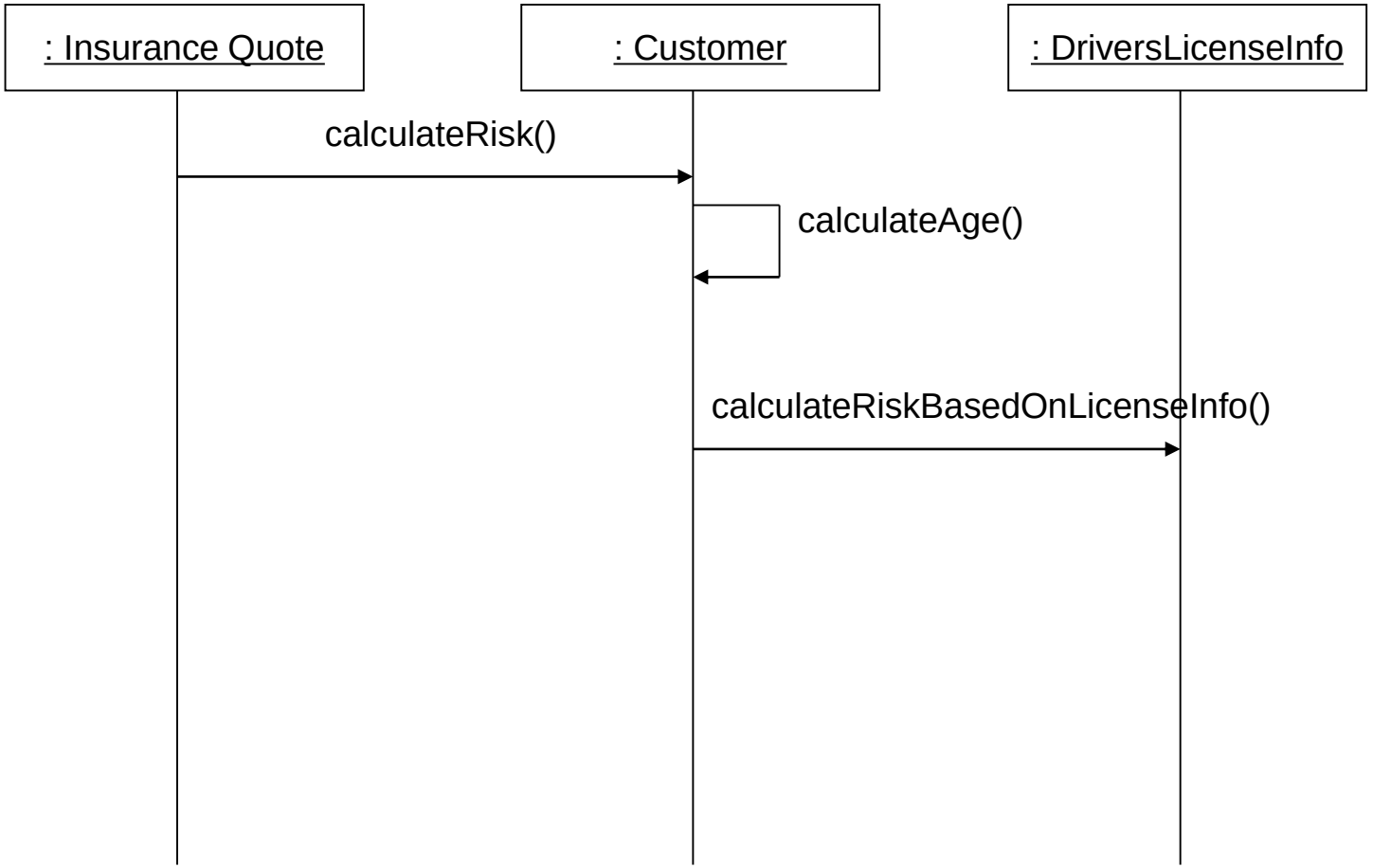
Tell, Don’t Ask



Ex 1 - Tell, Don’t Ask

- Analyse the dependencies in the source folder/project for Tell, Don’t Ask
  - What is the average class cohesion?
  - What are the average efferent and afferent couplings per class?
- Refactor the code to reduce couplings and improve class cohesion

Class Design Principles

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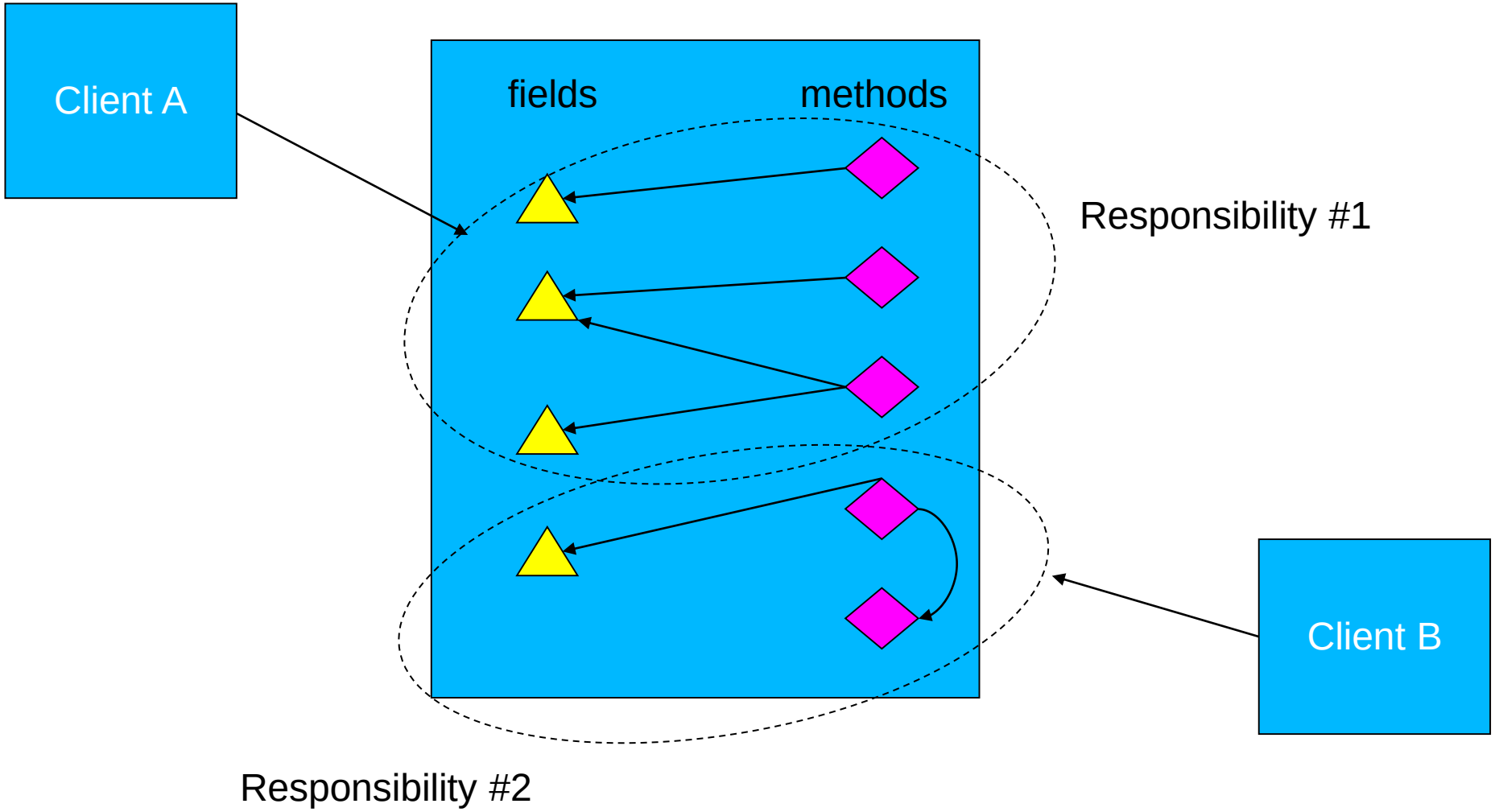
Single Responsibility

Classes Should Have Only One Reason To Change

Why? - #1



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Why? - #2

AB
CD
AB.CD
CD.AB

A
B
C
D
A.B
A.C
A.D
A.B.C
… etc

Ex 2 – Single Responsibility

- Identify the responsibilities of classes in the Single Responsibility source folder/project
- Refactor the code so that classes have only on responsibility

Open-Closed

Classes should be…

Open to Extension

Closed to Modification

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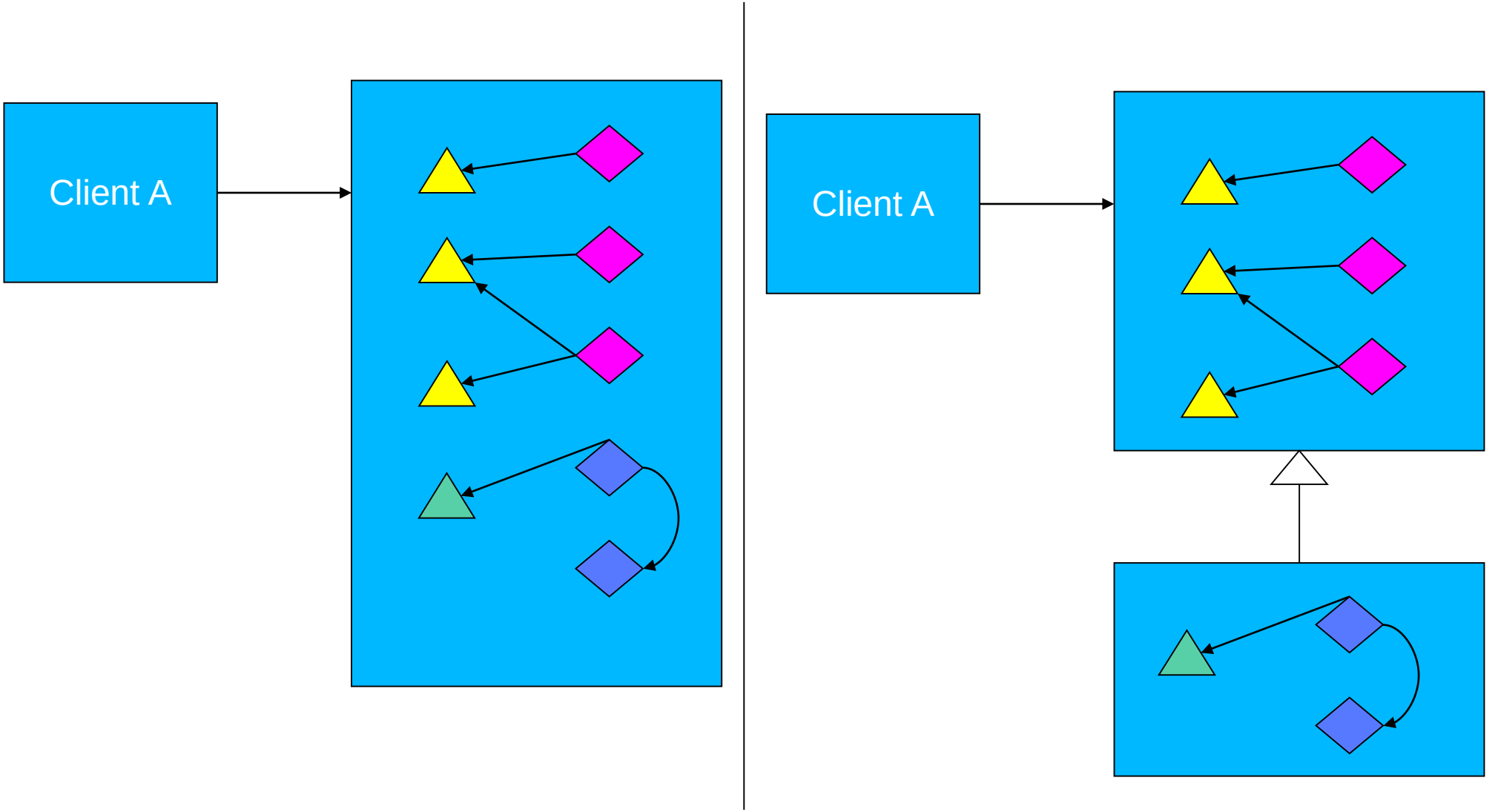
Why?



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Ex 3 – Open-Closed

- Add functionality to the code in the Open-Closed source project/folder to ensure customers are of legal age to rent videos with the following classifications:
  - 18
  - 15
  - 12
  - U

Liskov Substitution

An instance of a class can be substituted with an instance of any of its subclasses

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Ex 4 – Liskov Substitution

- Extend BankAccount in the Liskov Substitution source folder/project to allow customers to draw against an agreed overdraft limit
- Modify the tests to ensure that the subclass of BankAccount passes the tests for a BankAccount as well as tests for an account with an overdraft limit

Interface Segregation

Captain
- toss coin
- rally team
- say “at the end of the day” in post-match interviews

Employee
- correct boss’s mistakes
- attend appraisal
- request raise

Mother
- feed
- bath
- clothe
- do school run
- make nativity costume
- take to doctor
- etc etc etc

Wife
- put up with Xbox sessions
- invite fat mother for weekend

Classes should present client-specific interfaces

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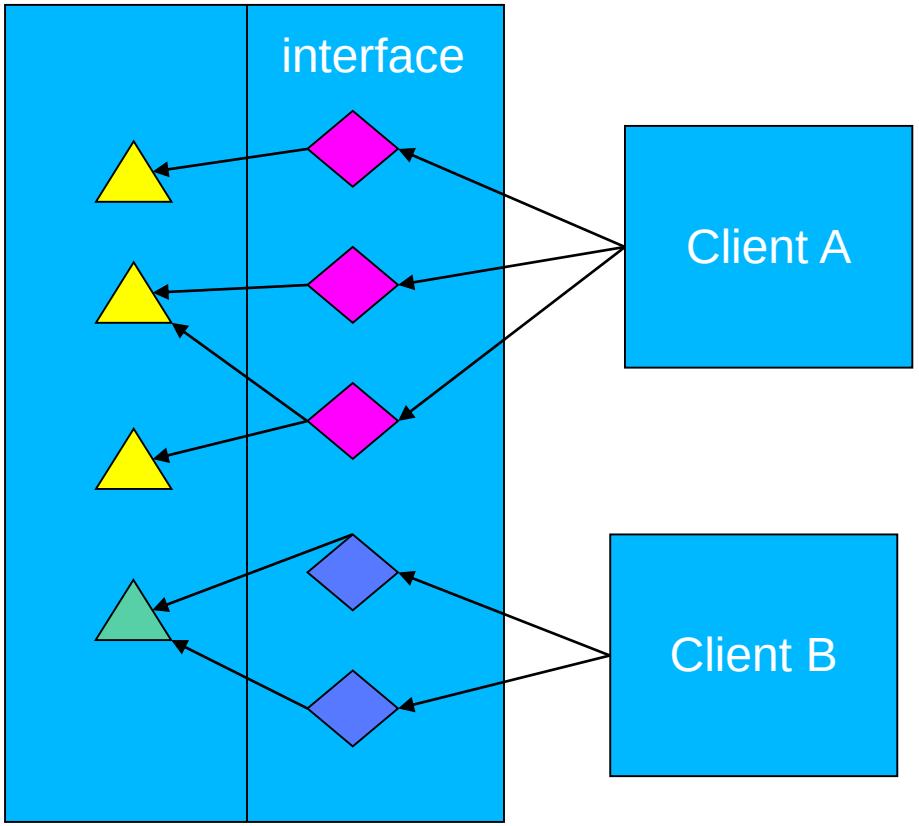
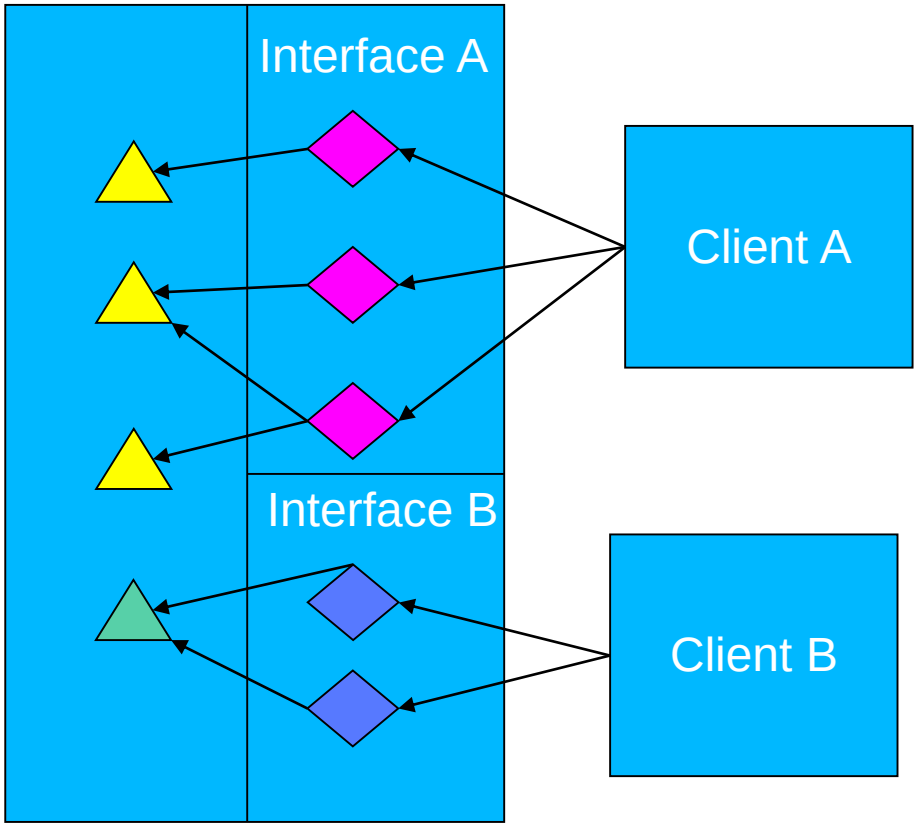
Why?





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Ex 5- Interface Segregation

- Refactor the classes in the Interface Segregation source folder/project so they present client-specific interfaces

Dependency Inversion

A. High-level modules should not depend on low-level modules. Both should depend on abstractions.
B. Abstractions should not depend upon details. Details should depend upon abstractions.

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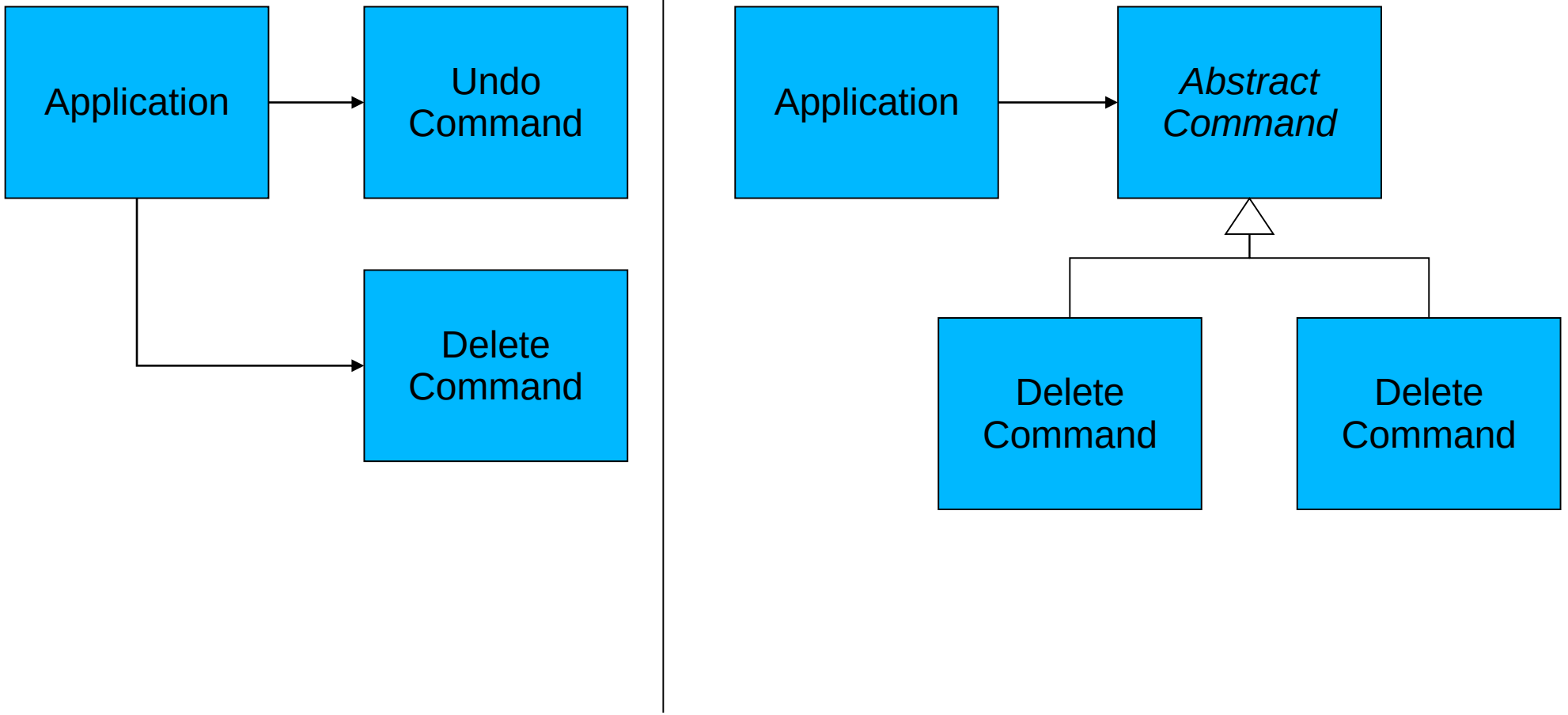
E.g. App class depends on concrete commands



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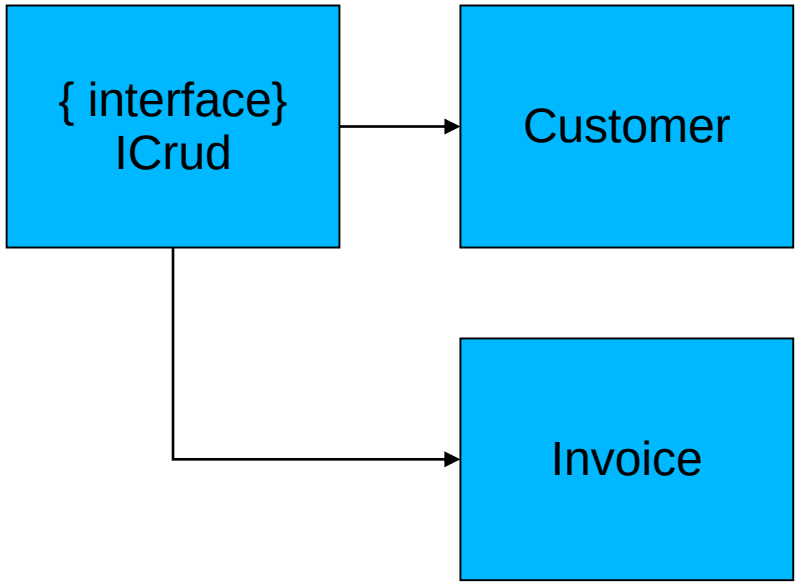
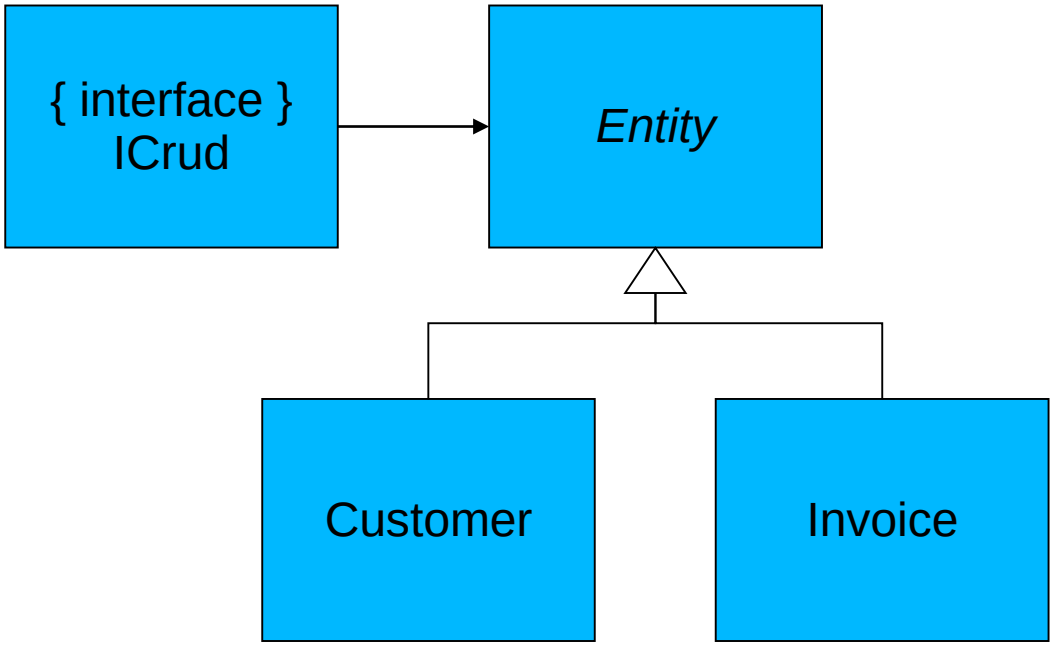
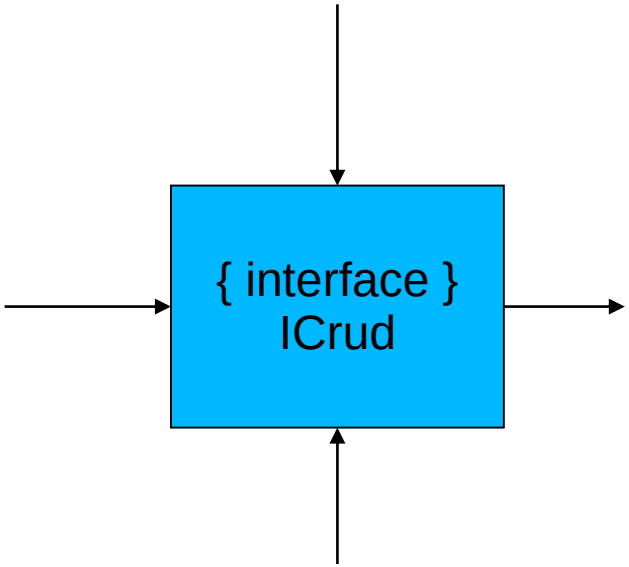
E.g. Interface depends on concrete classes

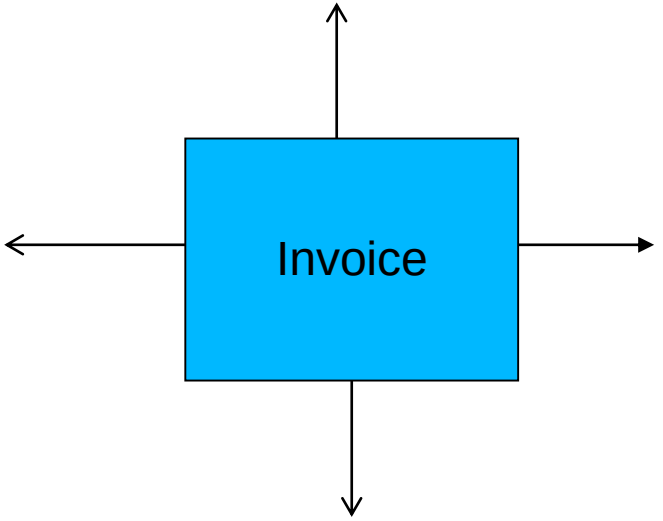




Dependency Inversion Analysis



Abstractions should have higher afferent/efferent couplings



Concrete classes should have higher efferent/afferent couplings

Ex 6 – Dependency Inversion

- Refactor the classes in the Dependency Inversion source folder/project so that higher-level classes don’t depend on lower-level classes, and abstractions don’t depend on details

More Class Design Principles

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Law of Demeter

Classes should only know about their nearest neighbours

Ex 7 – Law of Demeter

- Refactor the classes in the Law Of Demeter source folder/project so that classes only interact with their direct collaborators