# Agile Software Development

Produced by

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## **SOLID** Principles

*S* *The Single Responsibility Principle (SRP)*

- A class should have one, and only one, reason to change.

*O* *The Open Closed Principle (OCP)*

- You should be able to extend a classes behavior, without modifying it.

*L* *The Liskov Substitution Principle (LSP)*

- Derived classes must be substitutable for their base classes.

*I* *The* I*nterface Segregation Principle (ISP)*

- Make fine grained interfaces that are client specific.

*D* *The* D*ependency Inversion Principle (DSP)*

- Depend on abstractions, not on concretions.

## **SOLID** Principles – Scope for module

*S* *The Single Responsibility Principle (SRP – this week)*

- A class should have one, and only one, reason to change.

*O* *The Open Closed Principle (OCP – week 10)*

- You should be able to extend a classes behavior, without modifying it.

*L* *The Liskov Substitution Principle (LSP – week 12)*

- Derived classes must be substitutable for their base classes.

*I* *The Interface Segregation Principle (ISP)*

- Make fine grained interfaces that are client specific.

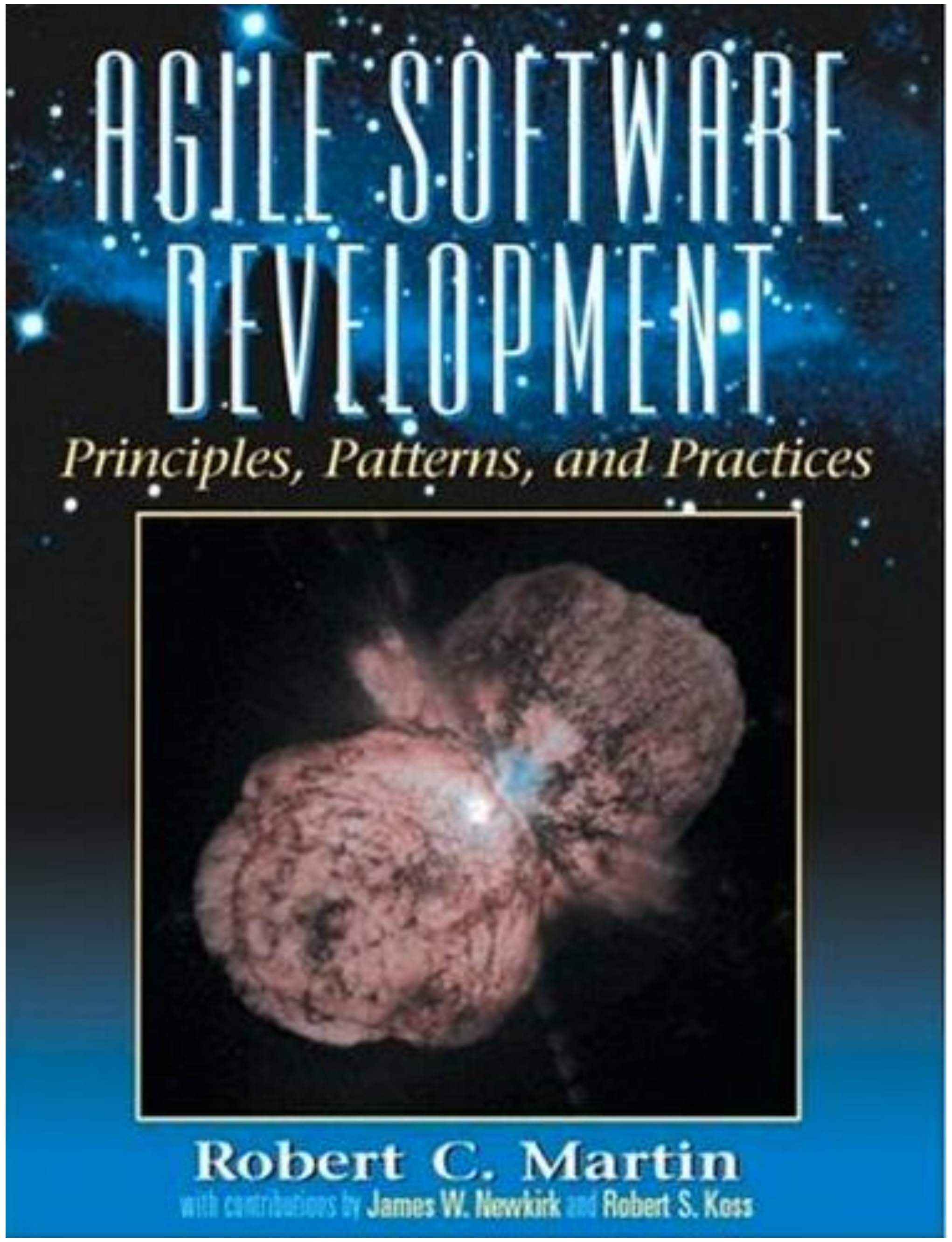
*D* *The Dependency Inversion Principle (DSP)*

- Depend on abstractions, not on concretions.

## Source

Sample Contents:

- Agile principles, and the fourteen practices of Extreme Programming
- Spiking, splitting, velocity, and planning iterations and releases
- Test-driven development, test-first design, and acceptance testing
- Refactoring with unit testing
- Pair programming
- Agile design and design smells
- The five types of UML diagrams and how to use them effectively.
- Object-oriented package design and design patterns.
- How to put all of it together for a real-world project


AGILE SOFTWARE DEVELOPMENT
Principles, Patterns, and Practices
Robert C. Martin
with contributions by James W. Newkirk and Robert S. Koss

## SOLID Principles in Poster form…

http://blogs.msdn.com/b/cdndevs/archive/2009/07/15/the-solid-principles-explained-with-motivational-posters.aspx

## SOLID

Software development is not a Jenga game.

## Single Responsibility Principle

Just because you *can* doesn't mean you *should*.

## “S” in SOLID - Single Responsibility Principle

Every object should have a single responsibility and that all of its services should be aligned with that responsibility.

“Responsibility” is defined as “a reason to change”, and ***Wikipedia does a pretty good job of explaining it***:

- As an example, consider a module that compiles and prints a report. Such a module can be changed for two reasons. First, the content of the report can change. Second, the format of the report can change. These two things change for very different causes; one substantive, and one cosmetic. The single responsibility principle says that these two aspects of the problem are really two separate responsibilities, and should therefore be in separate classes or modules. It would be a bad design to couple two things that change for different reasons at different times.

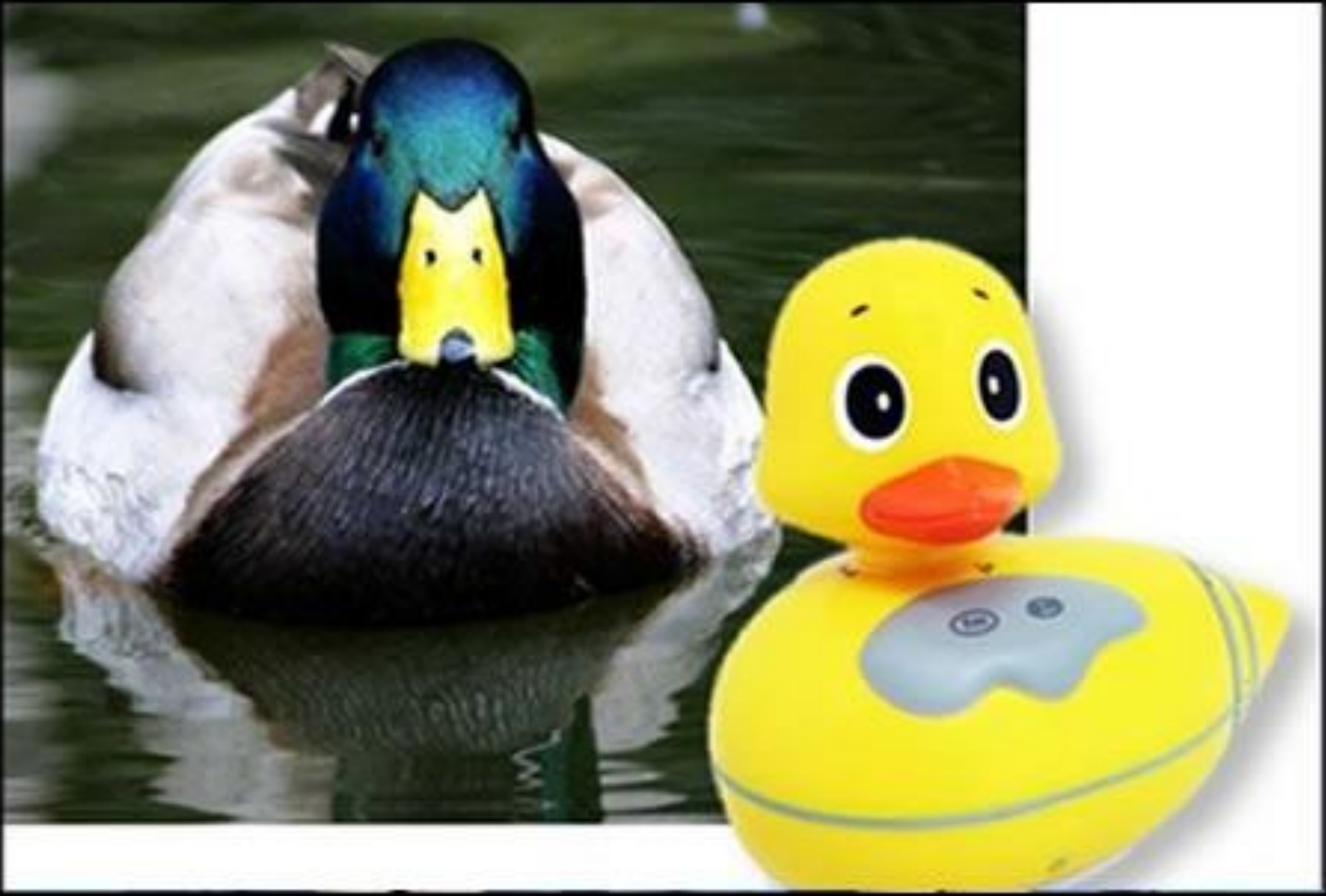
## Open-Closed Principle

Open-chest surgery isn't needed when putting on a coat.

## “O” in SOLID - Open-Closed Principle

- Software entities – such as classes, modules, functions and so on – should be open for extension but closed for modification.

- The idea is that it’s often better to make changes to things like classes by adding to or building on top of them (using mechanisms like subclassing or polymorphism) rather than modifying their code.



## Liskov Substitution Principle

If it looks like a duck and quacks like a duck but needs batteries, you probably have the wrong abstraction.

## “L” in SOLID - Liskov Substitution Principle

- Subclases should be substitutable for the classes from which they were derived.
- For example, if MySubclass is a subclass of MyClass, you should be able to replace MyClass with MySubclass without bunging up the program.

## Interface Segregation Principle

You want me to plug this in *where?*

## “I” in SOLID - Interface Segregation Principle

*Many client specific interfaces are better than one general purpose interface.*

*Make fine grained interfaces that are client specific.*

*outside the scope of this module*

# DEPENDENCY INVERSION PRINCIPLE

Would You Solder A Lamp Directly To The Electrical Wiring In A Wall?

## “D” in SOLID - Dependency Inversion Principle

- High-level modules shouldn’t depend on low-level modules, but both should depend on shared abstractions.

- In addition, abstractions should not depend on details – instead, details should depend on abstractions.

*Depend on abstractions, not on concretions.*

*outside the scope of this module*

- In your own time, see the Manager example here.

## SRP – Single Responsibility Principle

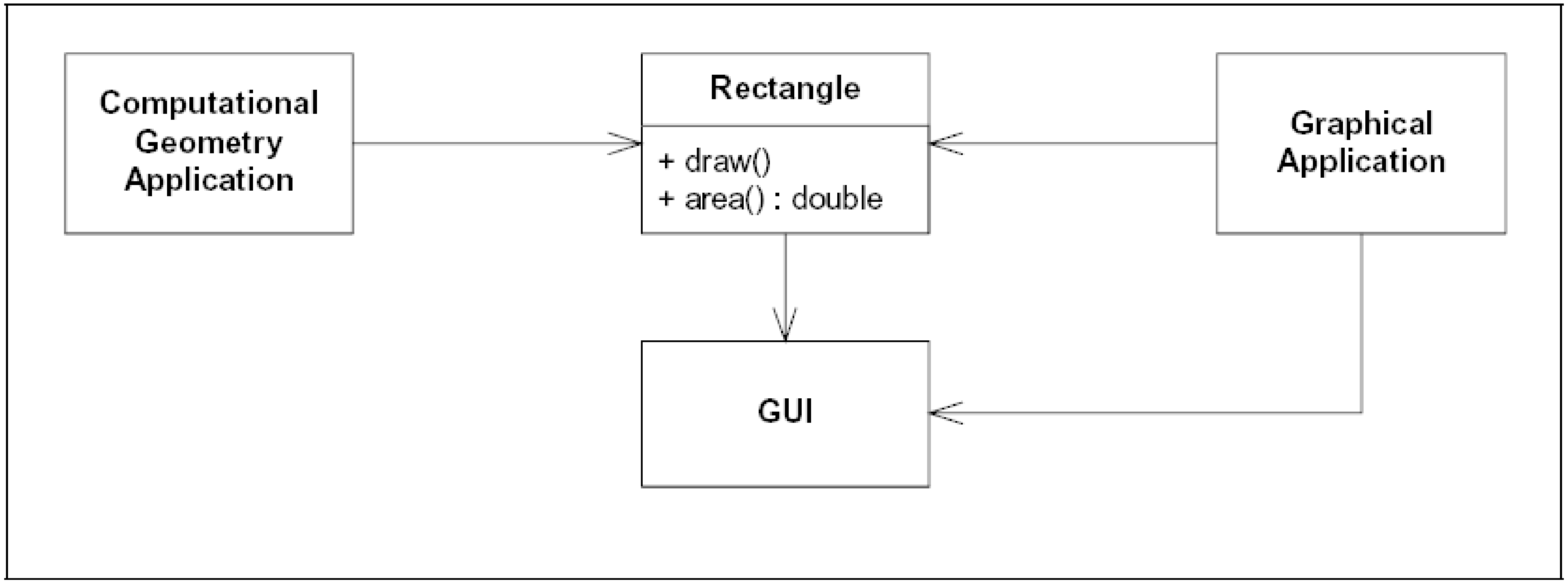
## SRP: The Single Responsibility Principle

**THERE SHOULD NEVER BE MORE THAN ONE REASON FOR A CLASS TO CHANGE.**

- Each responsibility is an axis of change.
- When the requirements change, that change will be manifested through a change in responsibility amongst the classes.
- If a class assumes more than one responsibility, then there will be more than one reason for it to change.
- Changes to one responsibility may impair or inhibit the class' ability to meet the others.

# Example

- The Rectangle class has two methods:
  - one draws the rectangle on the screen
  - the other computes the area of the rectangle.
- Two applications use this class:
  - one application uses Rectangle to help it with the mathematics of geometric shapes.
  - the other uses the class to render a Rectangle on a window.



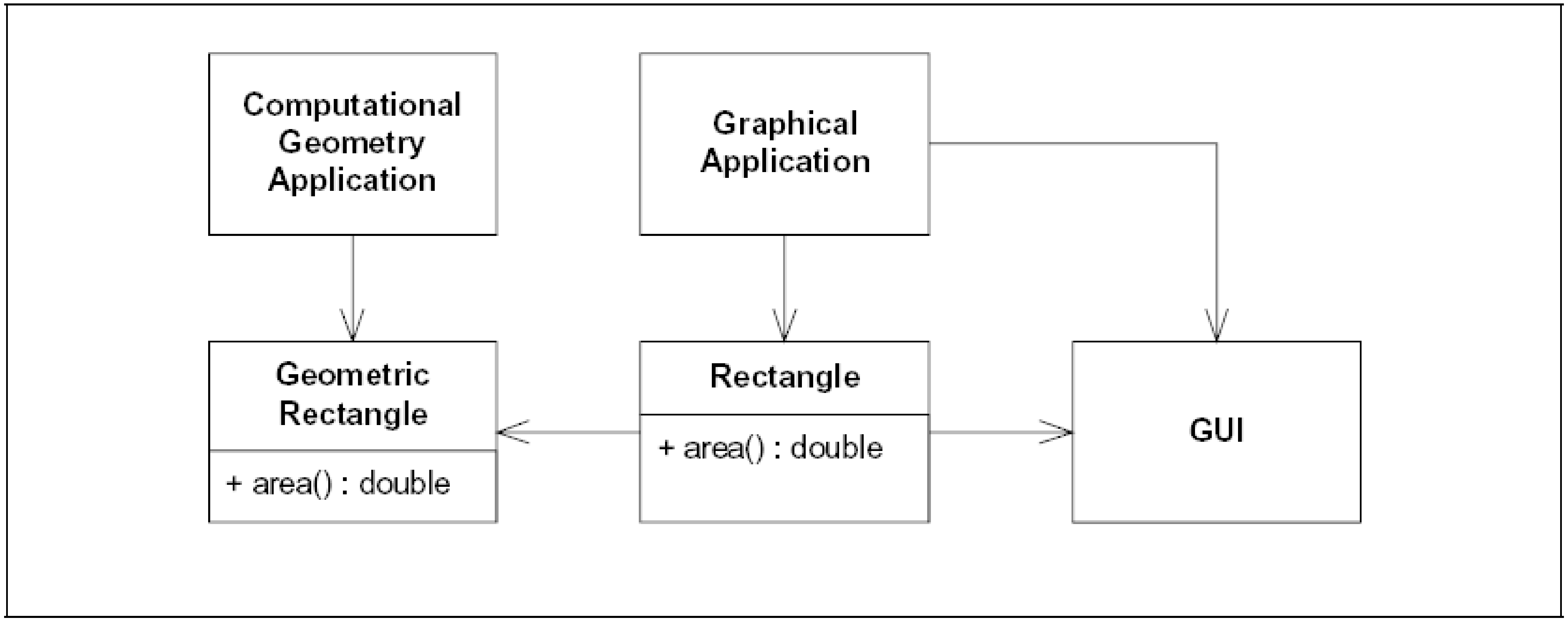
## SRP Violation

- Rectangle has two responsibilities:
  - provide a mathematical model of the geometry of a rectangle.
  - render the rectangle on a graphical user interface.

- Violation of SRP:
  - the GUI must be included in the in the computational geometry application.
    - the class files for the GUI have to be deployed to the target platform.
  - if a change to the Graphical Application causes the Rectangle to change for some reason, that change may force us to rebuild, retest, and redeploy the Computational Geometry Application.

## SRP Fix

- Separate the two responsibilities into two separate classes
  - Moves the computational portions of Rectangle into the GeometricRectangle class.
- Now changes made to the way rectangles are rendered cannot affect the ComputationalGeometry Application.



## What is a Responsibility?

- “A reason for change.”
- If you can think of more than one motive for changing a class, then that class has more than one responsibility.

```
interface Modem
{
  void dial(String pno);
  void hangup();
  void send(char c);
  char recv();
}
```

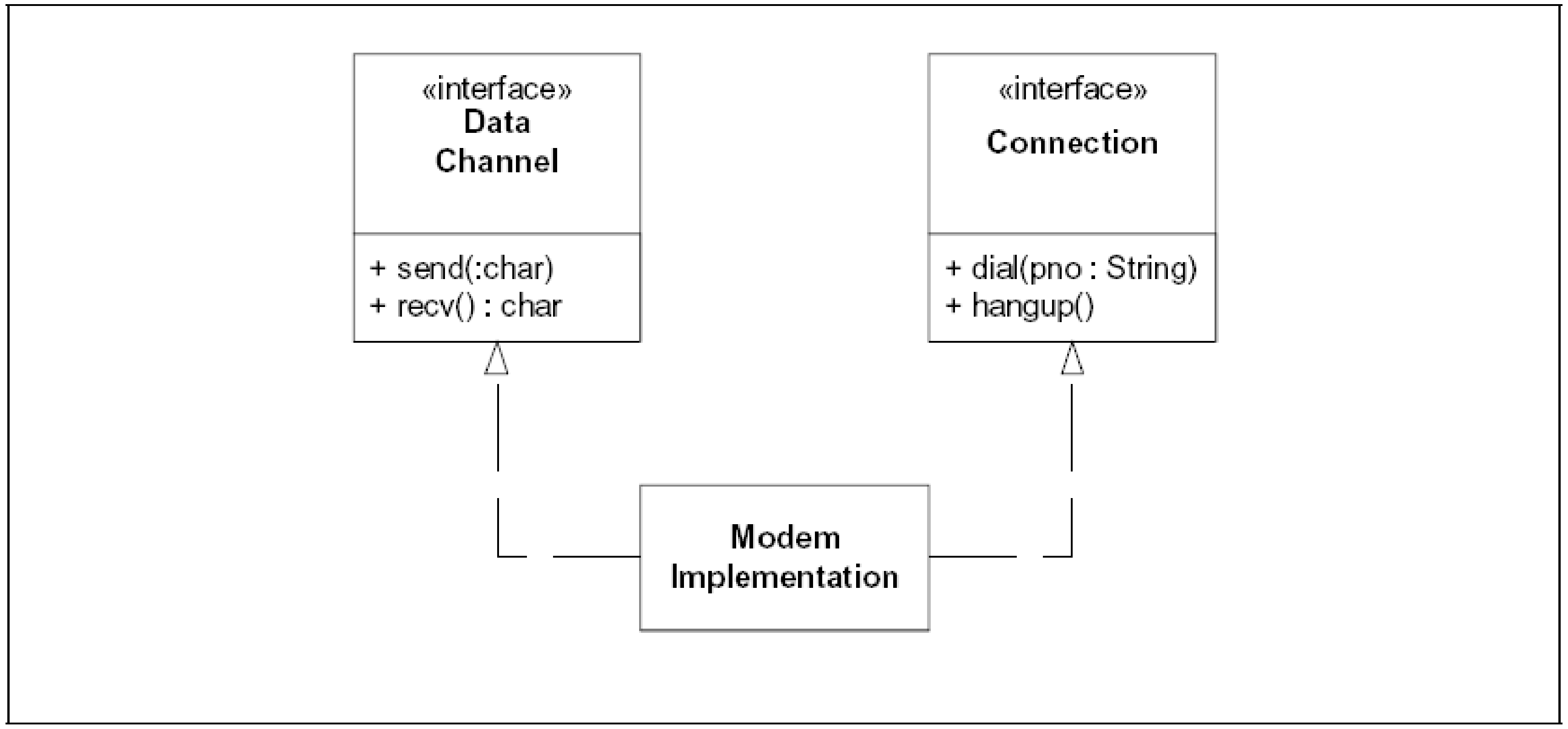
## Modem Responsibilities

```
interface Modem
{
  void dial(String pno);
  void hangup();
  void send(char c);
  char recv();
}
```

- Two responsibilities:
  - connection management (dial and hangup functions)
  - data communication (send and recv functions)
- They have little in common
  - may change for different reason
  - will be called from different parts of the applications
- They will change for different reasons.

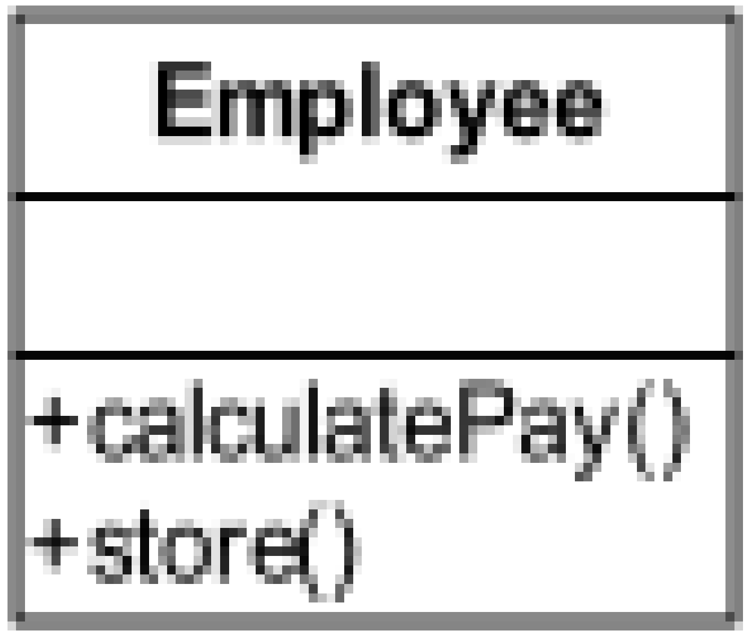
## Separation of Responsibilities

- Separate the two responsibilities into two separate interfaces.
- However, we may couple the two responsibilities into a single Modem Implementation class.
- This is not necessarily desirable, but it may be necessary. (for implementation purposes)

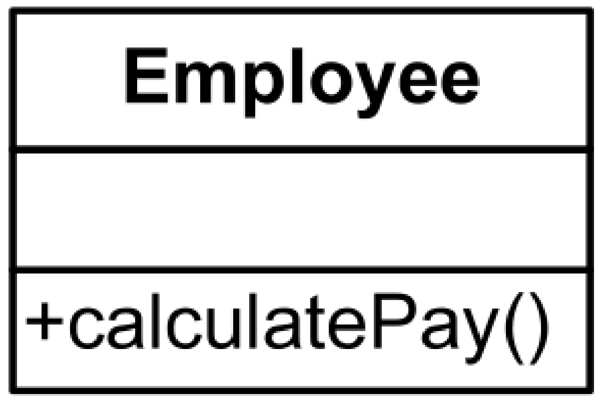


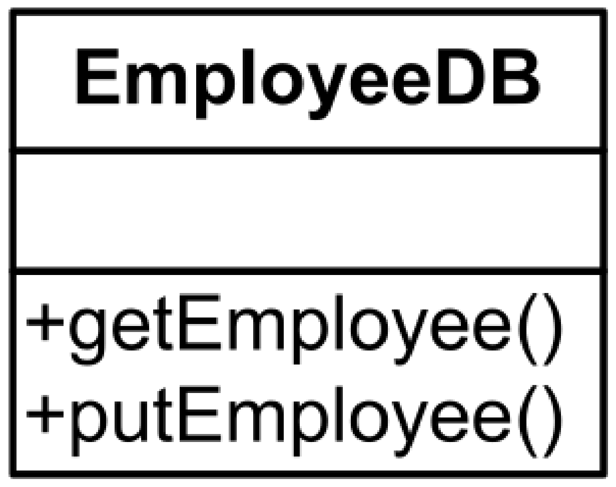
## SRP Violation?

- Coupling persistence services (store) with business rules (calculatePay) violates SRP



## Separate Concerns



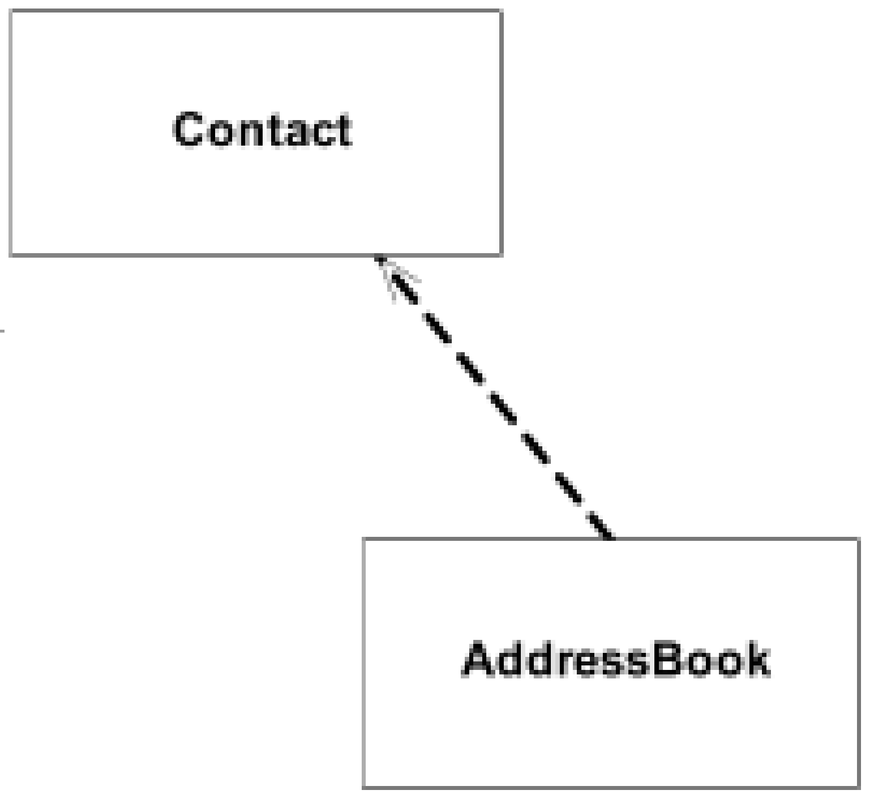


## Example - Personal Information Manager

- Design an Application to manage a contact list.

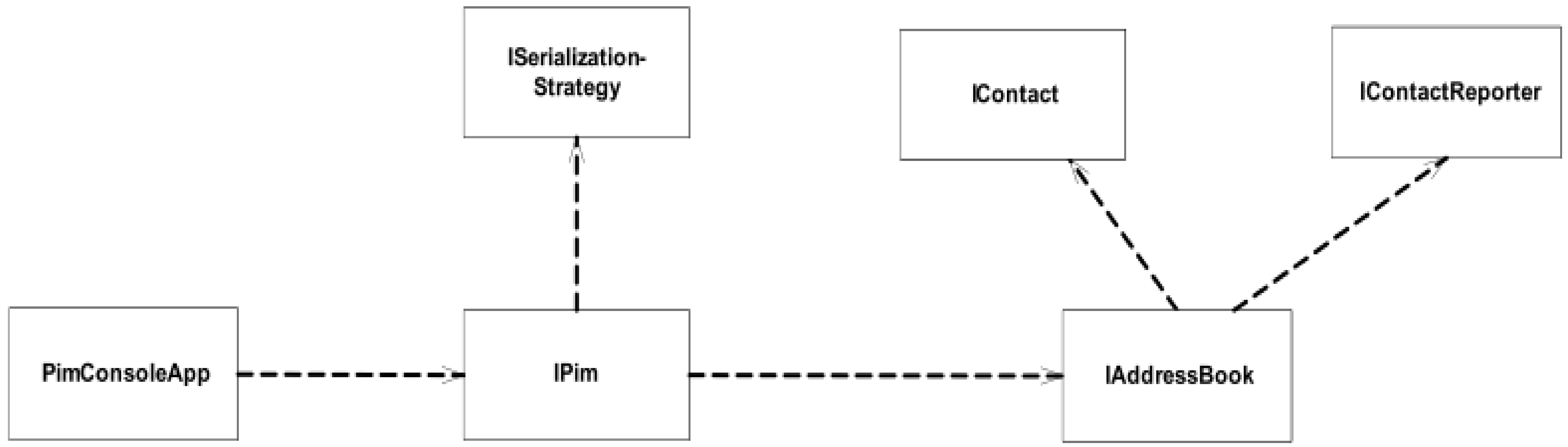
- It should support:
  - Console based UI
  - Load/save to/from a file on disk
  - Simple reports and search functions

# AddressBook



- Propose two classes:
  - Contact - to represent each contact
  - AddressBook - to incorporate
    - serialization
    - reporting
    - UI
    - etc…
- Violates SRP as AddressBook has multiple reasons to change
  - Data structure change (e.g. HashMap to TreeMap)
  - Serialization mechanism (e.g. binary to XML)
  - Alternative reports (e.g. different formats and content)
  - Command line syntax changes

# Refactor Addressbook

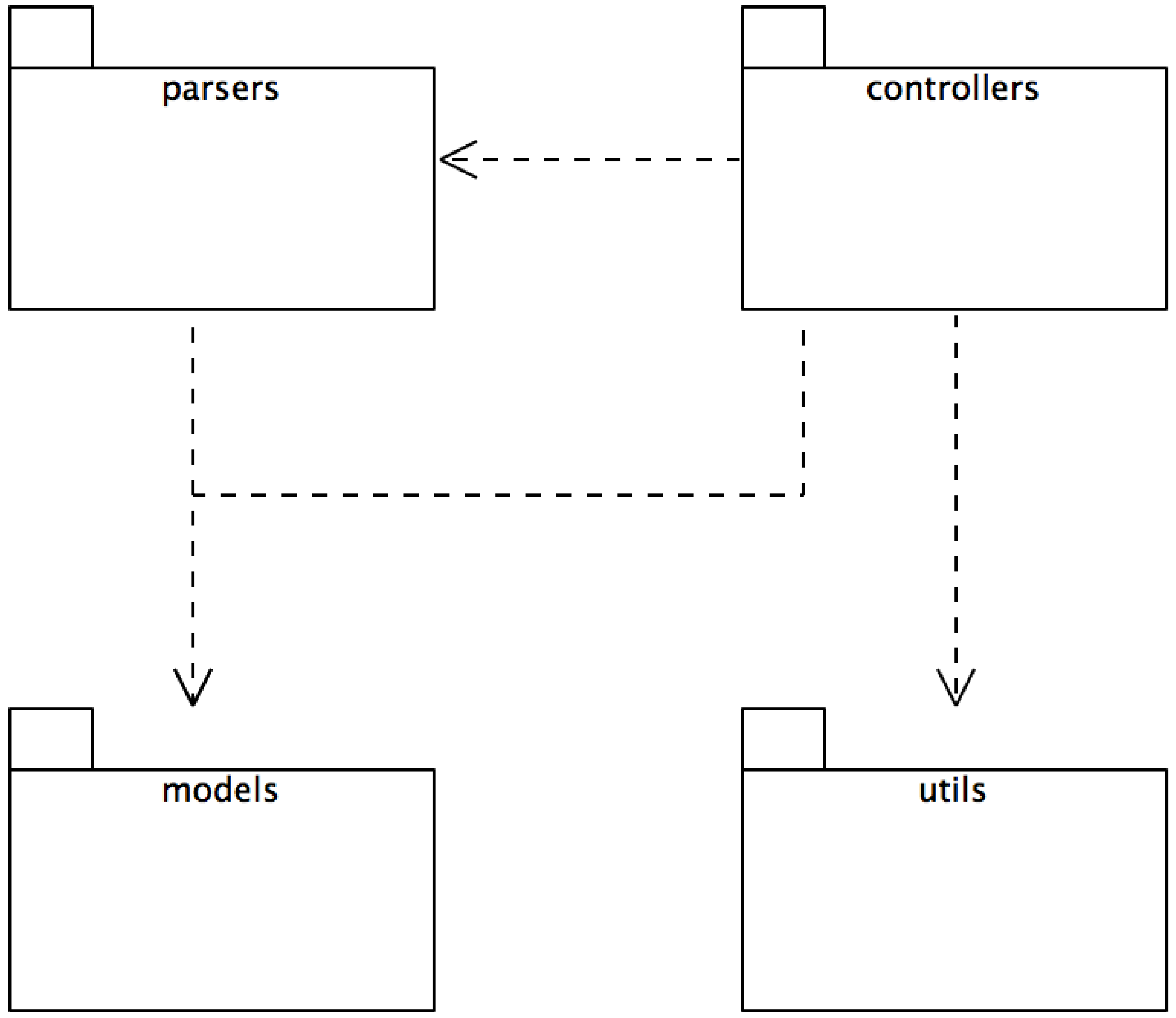


| | |
|---|---|
| AddressBook | responsible for contact data structure |
| ContactReporter | responsible for format and content of reports |
| SerializationStrategy | responsible for persistence |
| Pim | responsible for binding address book to serialization mechanism – and for exposing coherent top level functionality |
| PimConsoleApp | responsible binding an running application to an IPim. |

# Pacemaker - package responsibilities

transform the model into various formats

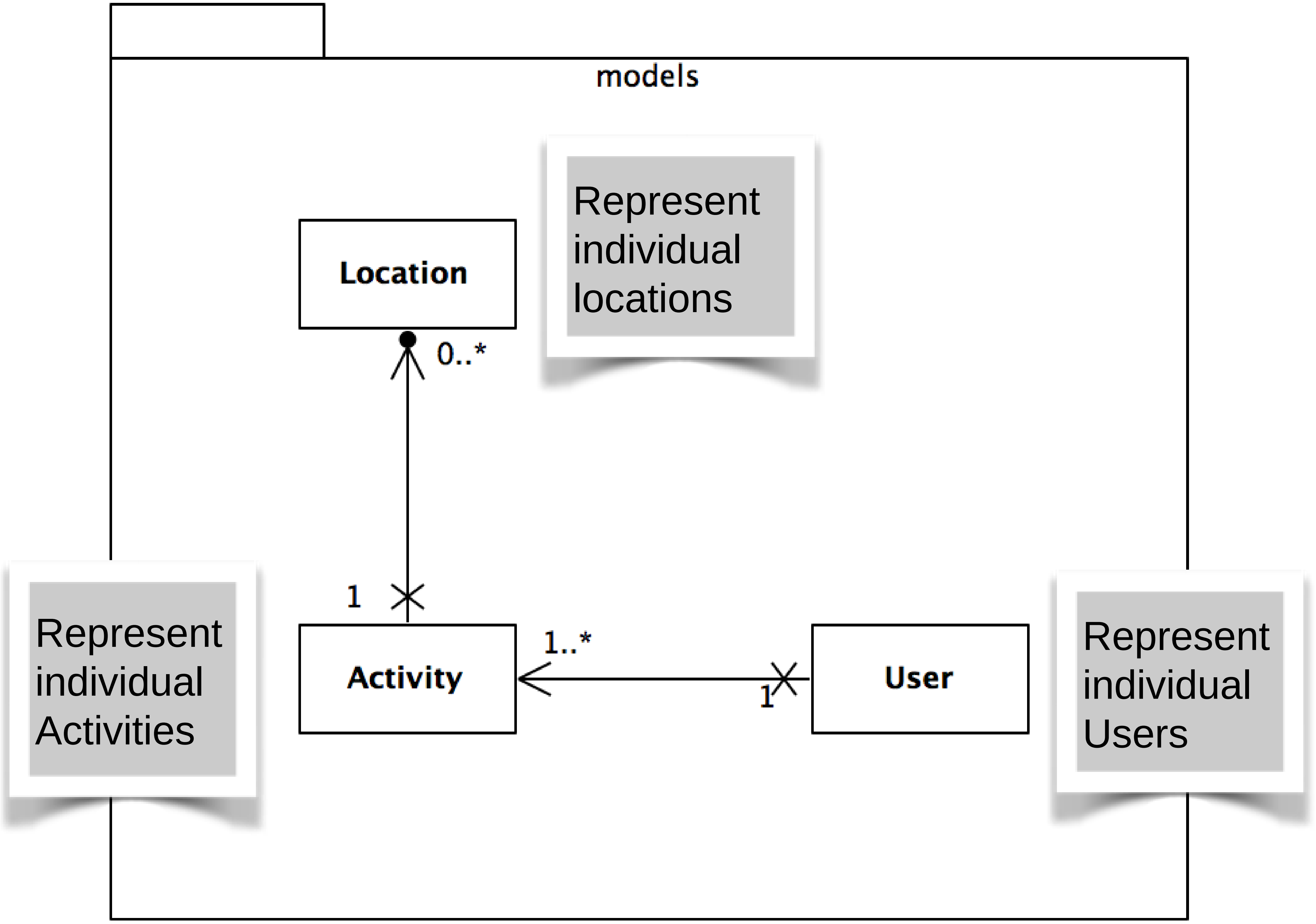
Application services + user interface



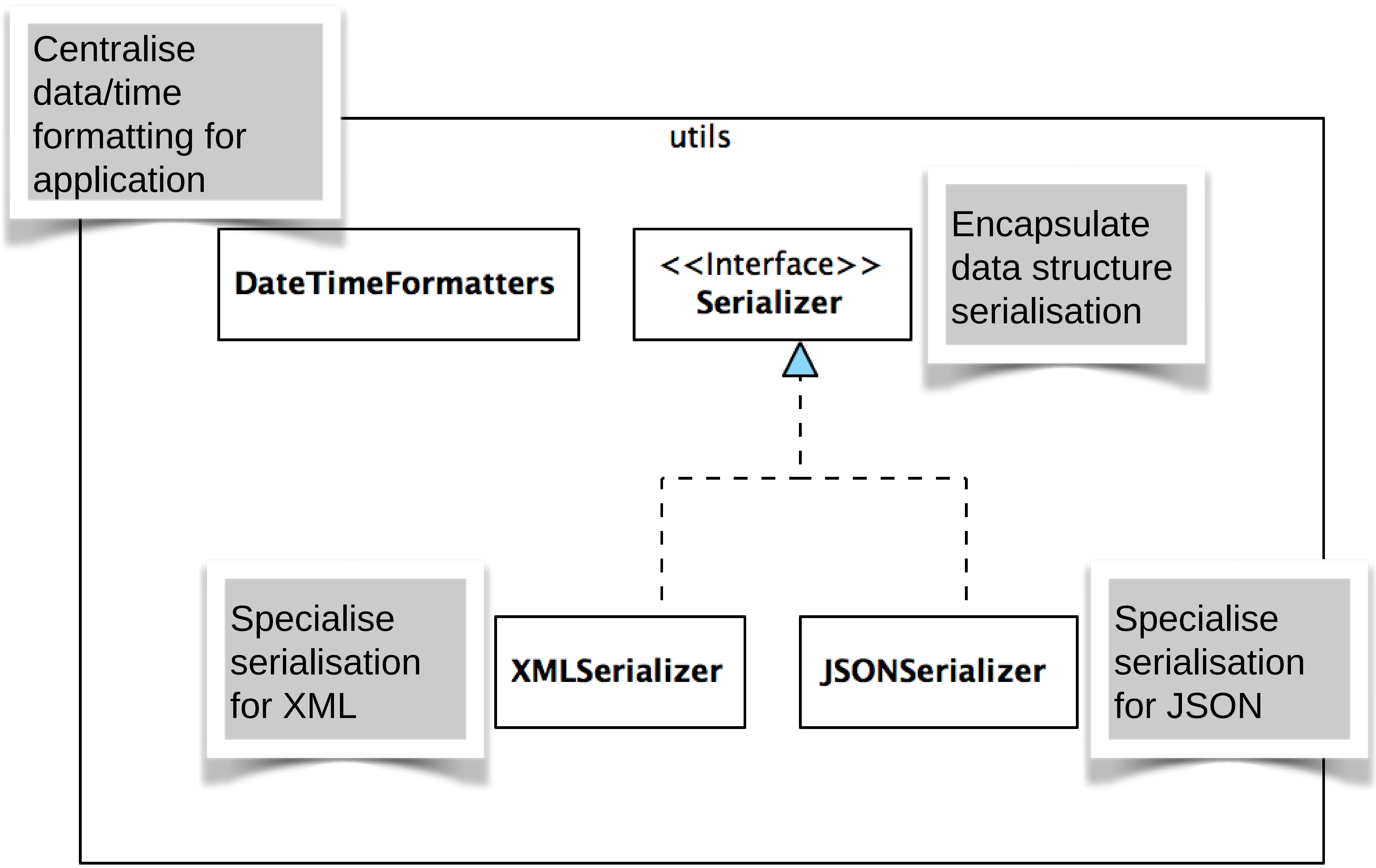
information model for the app

general purpose application independent utilities

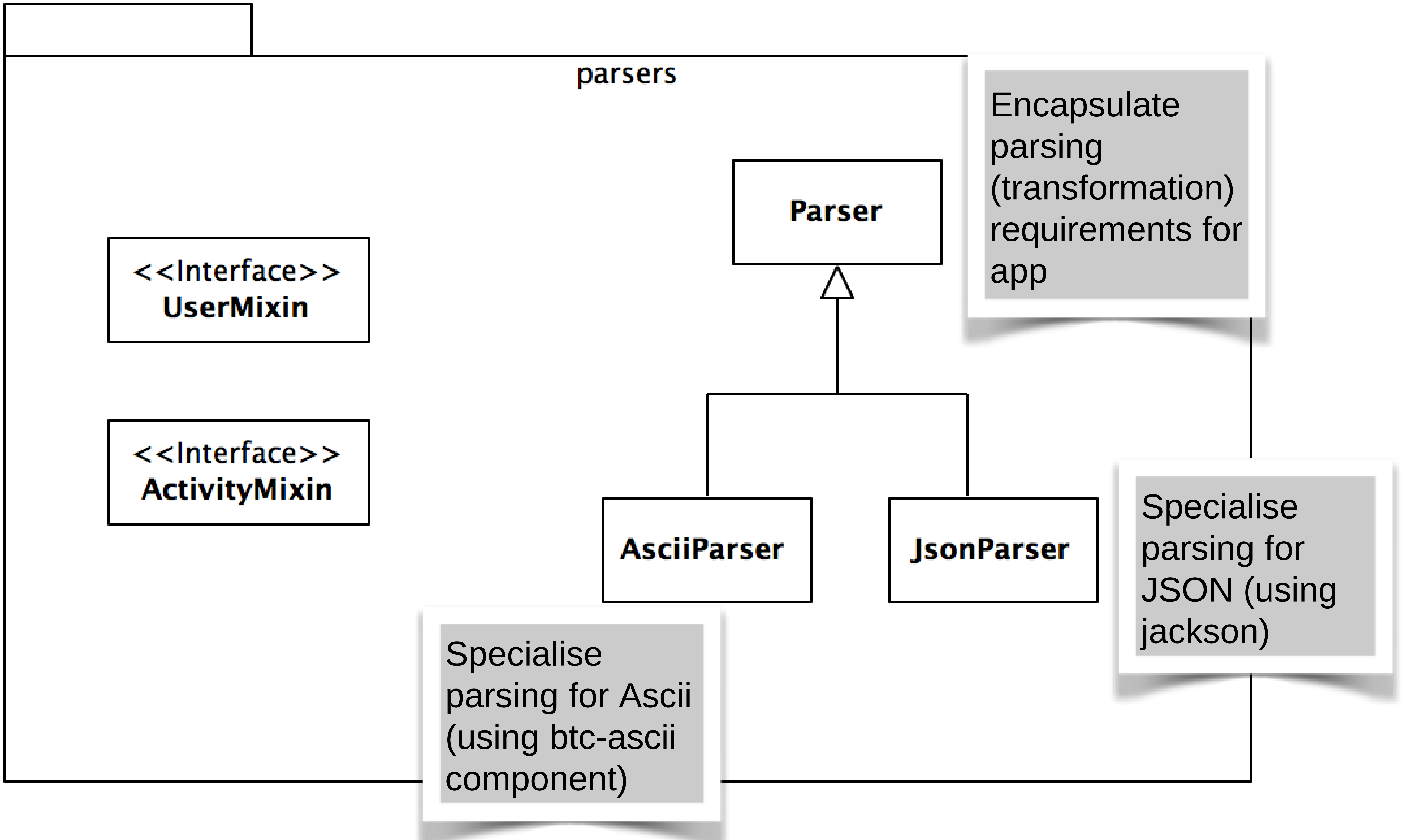
## Pacemaker – model responsibilities


models
Location
Activity
User
0..*
1
1..*
1
Represent individual locations
Represent individual Activities
Represent individual Users

## Pacemaker – utils responsibilities


Centralise data/time formatting for application
utils
DateTimeFormatters
<<Interface>> Serializer
Encapsulate data structure serialisation
Specialise serialisation for XML
XMLSerializer
JSONSerializer
Specialise serialisation for JSON

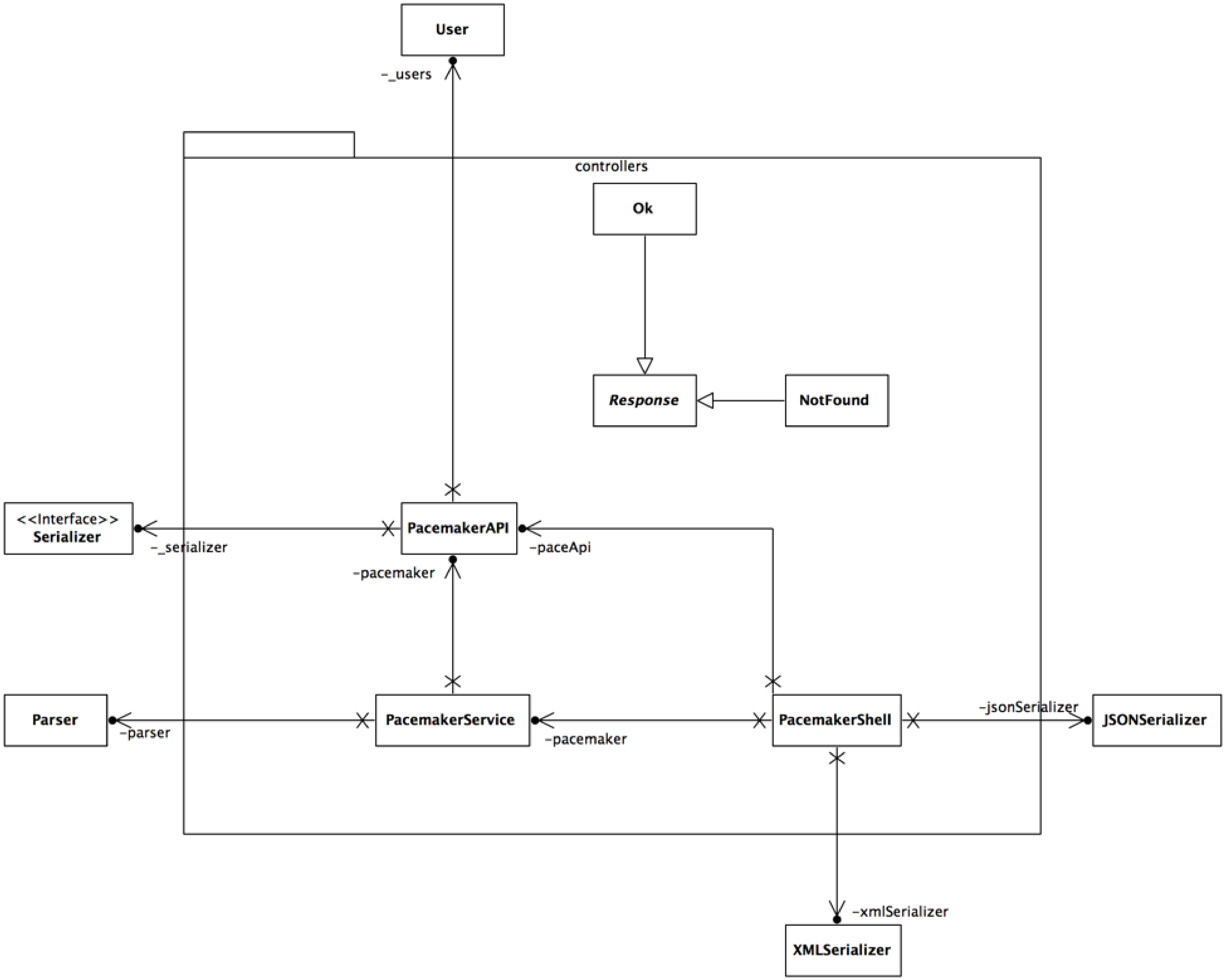
# Pacemaker – parsers responsibilities



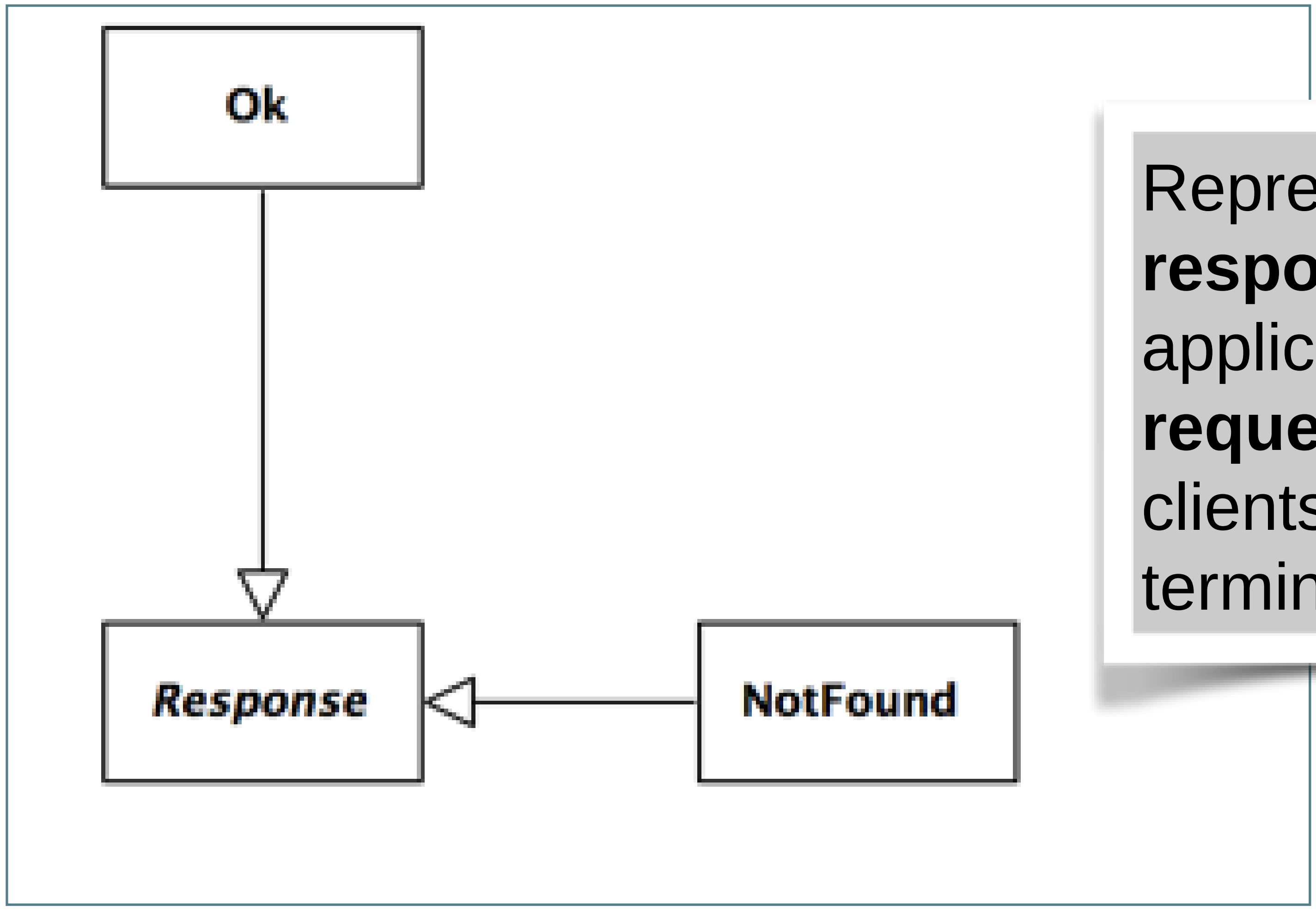
Encapsulate parsing (transformation) requirements for app

Specialise parsing for JSON (using jackson)

Specialise parsing for Ascii (using btc-ascii component)

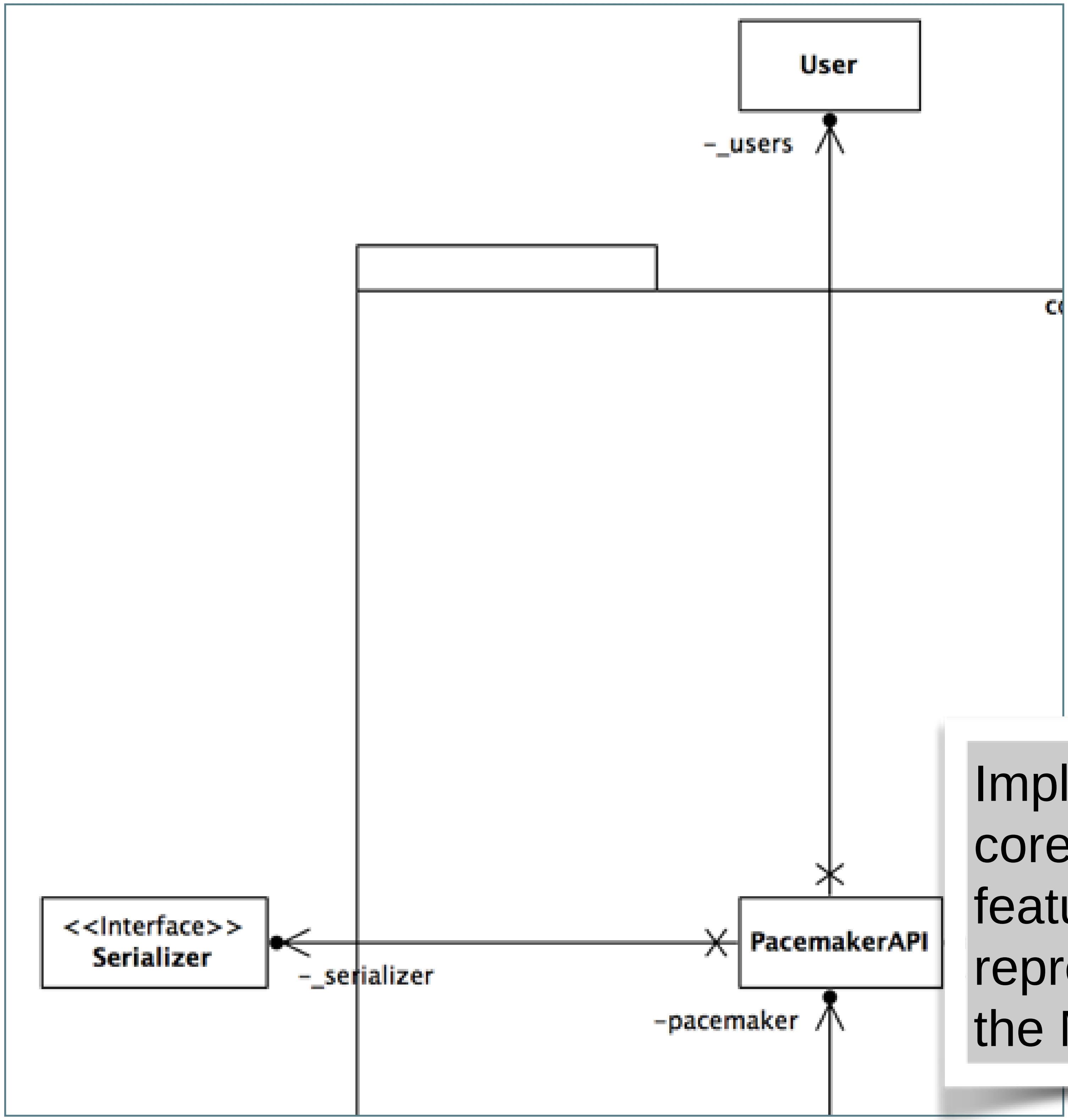

User
-_users
controllers
Ok
Response
NotFound
<<Interface>>
Serializer
-_serializer
PacemakerAPI
-paceApi
-pacemaker
Parser
-parser
PacemakerService
-pacemaker
PacemakerShell
-jsonSerializer
JSONSerializer
-xmlSerializer
XMLSerializer

## Pacemaker – Response responsibilities



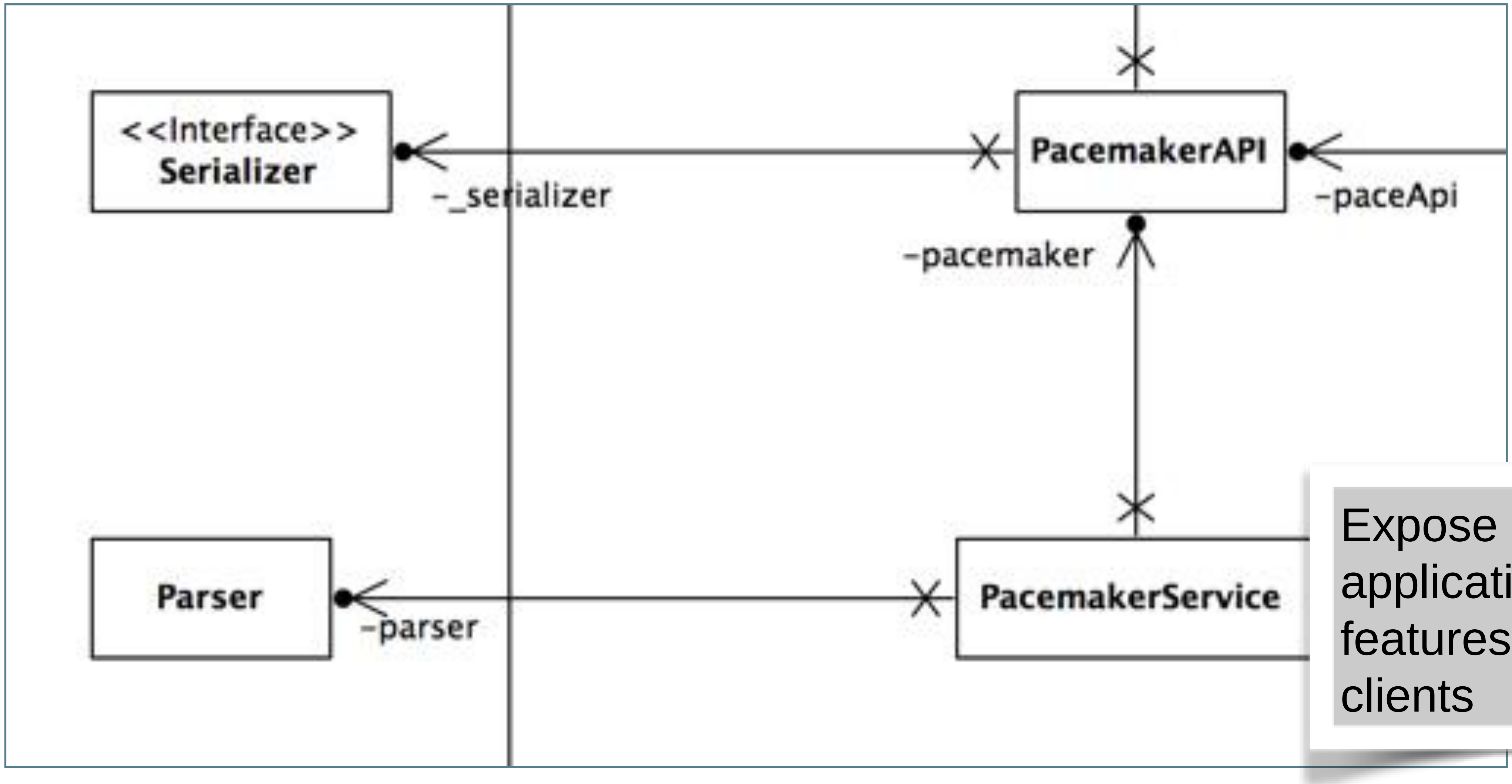
Represent **responses** from an application to **requests** from clients (use HTTP terminology)

# Pacemaker – PacemakerAPI responsibilities



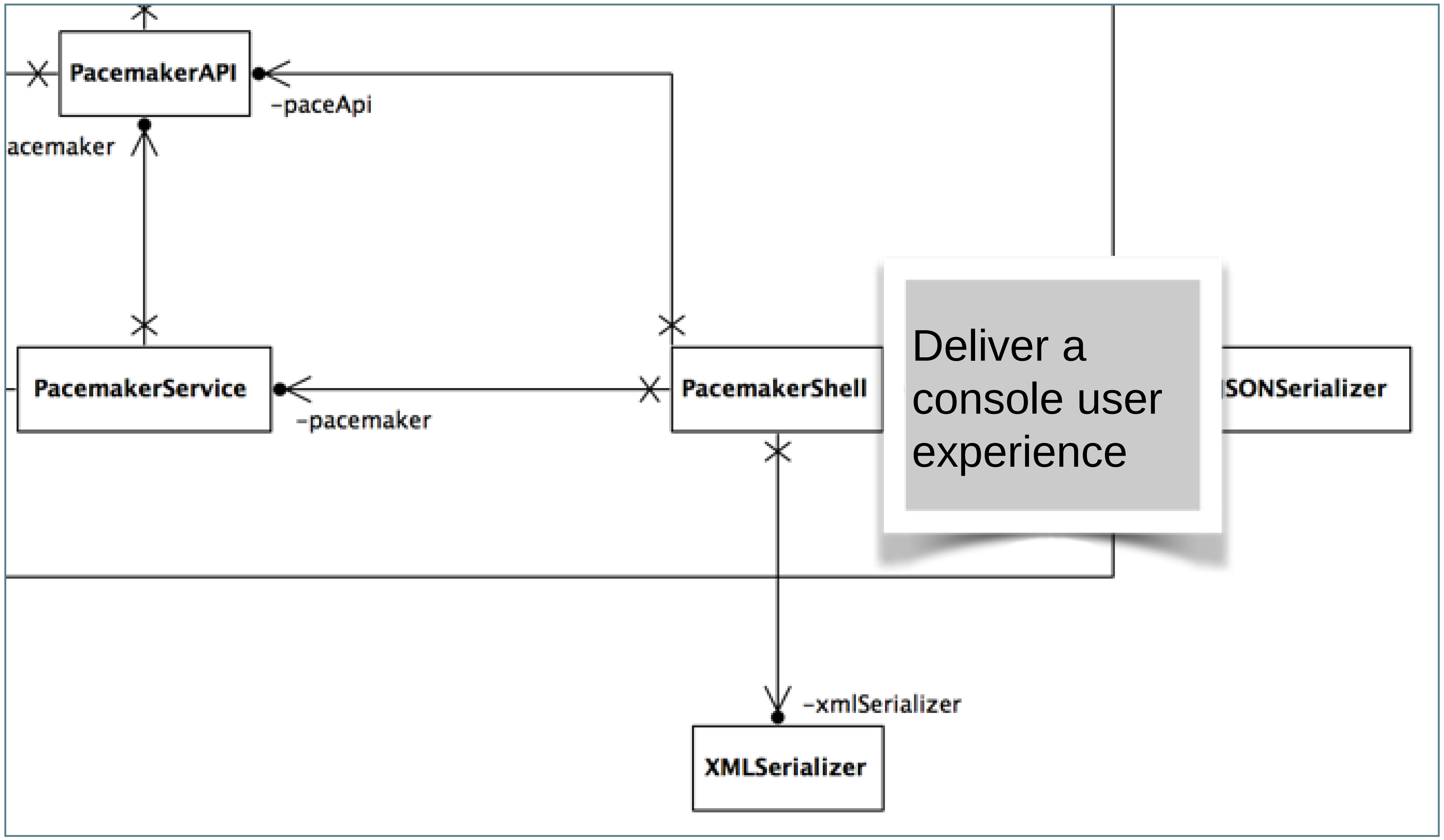
Implement the core application features as represented by the Model.

## Pacemaker – PacemakerService responsibilities



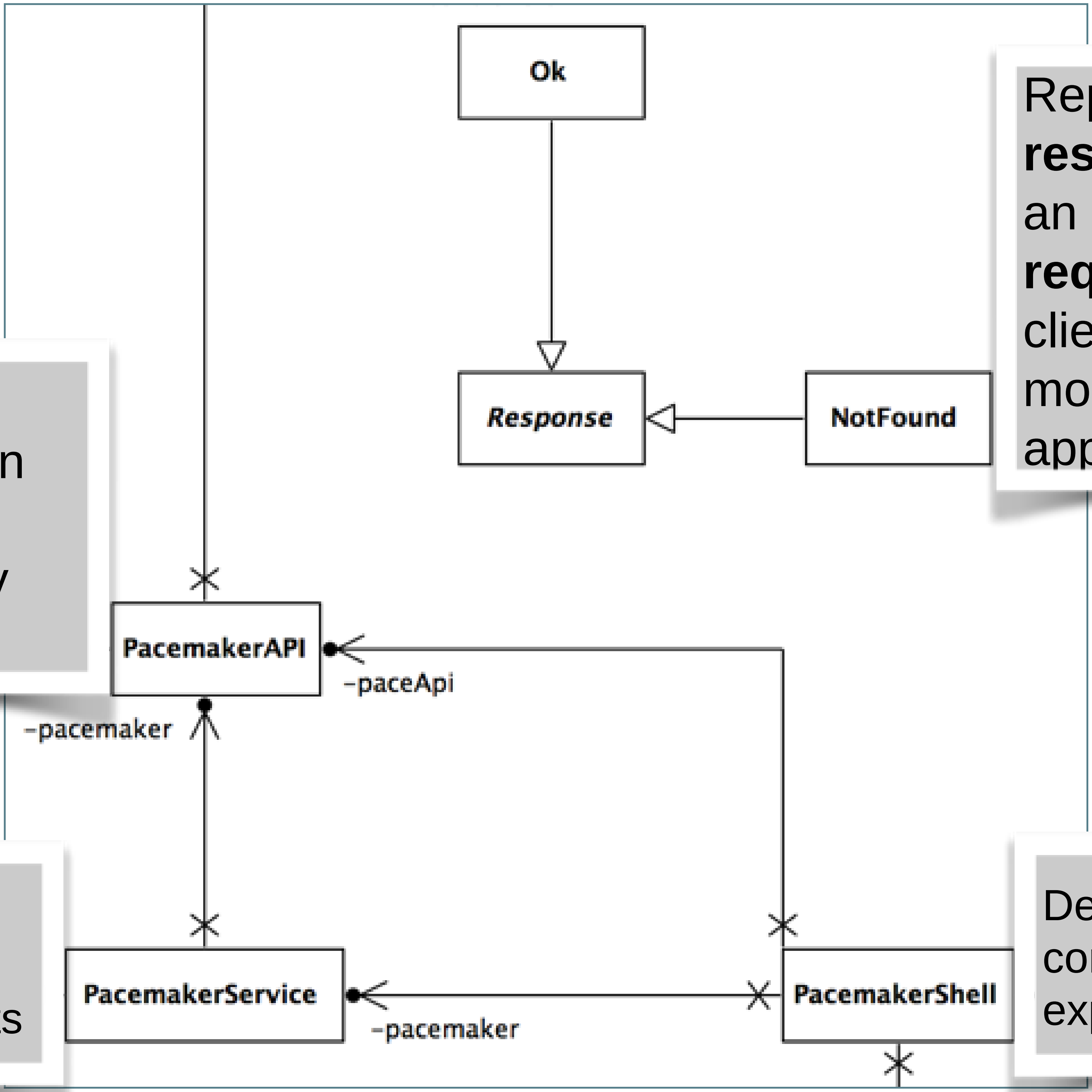
Expose the core application features to clients

## Pacemaker – PacemakerShell responsibilities



Deliver a console user experience

# Pacemaker – controllers responsibilities



Represent **responses** from an application to **requests** from clients(information modelled for the app on HTTP)

Implement the core application features as represented by the Model.

Expose the core application features to clients

Deliver a console user experience

## SRP Summary

- Changes in requirements are manifested as changes in class responsibilities.
- Therefore a ‘cohesive’ responsibility is a single axis of change – requirement changes often are restricted to a few cohesive responsibilities (in a reasonably designed system).
- Thus, to avoid coupling responsibilities that change for different reasons, a class should have only one responsibility, one reason to change.
- Violation of SRP causes spurious dependencies between modules that are hard to anticipate, in other words fragility.

## Single Responsibility Principle

Just because you *can* doesn't mean you *should*.

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