



Design Patterns



<Patterns>

- You need to hang a poster on the wall...
 - What do you do?
- You need to write a term paper...
 - How should it be organized?

Design Patterns

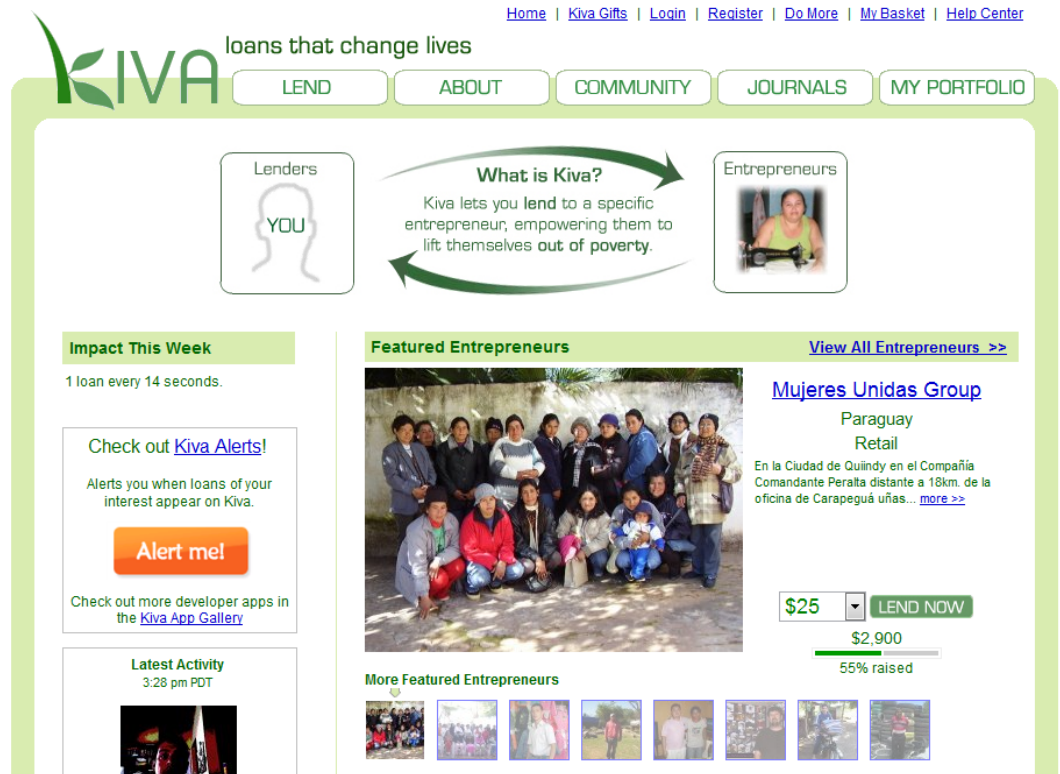
- Design patterns (DPs) are...
 - Strategies for your “toolkit of ideas”
 - Templates for solutions
 - Codified best practices
- Design patterns are not...
 - Architectural styles (DPs are too low level)
 - Code libraries (DPs are ideas, not code)

Design Patterns

- Primary goals of DPs
 - To help maintainability, flexibility, other quality attributes
 - To help system designers make good decisions
- There are a few dozen very common OO patterns
 - Patterns exist for other kinds of non-OO systems.
 - Patterns are recognizable based on their *structure and their purpose*.

Example System

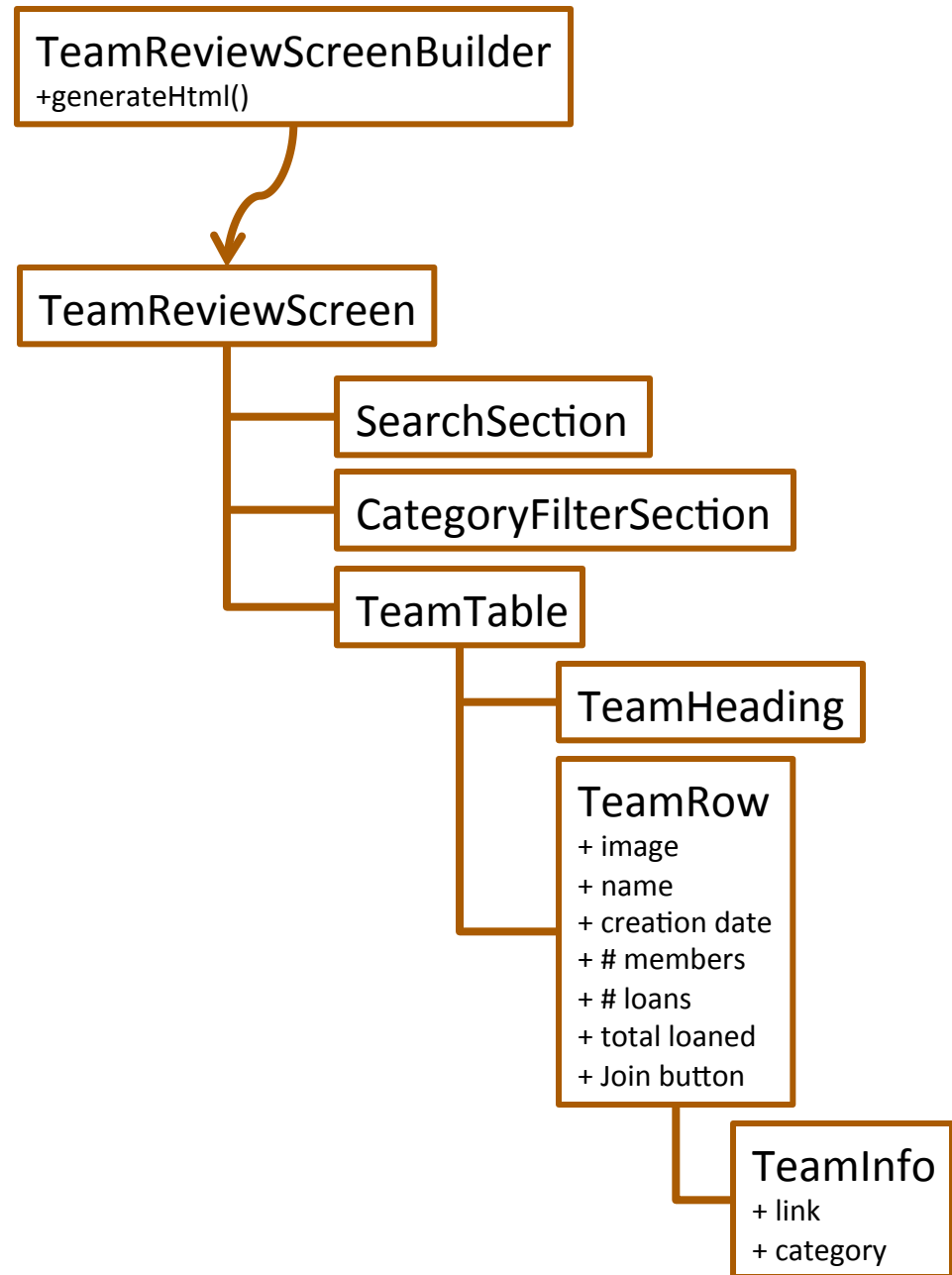
- Kiva system to connect lenders with borrowers
 - How could we use DPs to implement Kiva?
 - How could we use DPs to implement a better Kiva???



Builder

Knows how to create a complex object

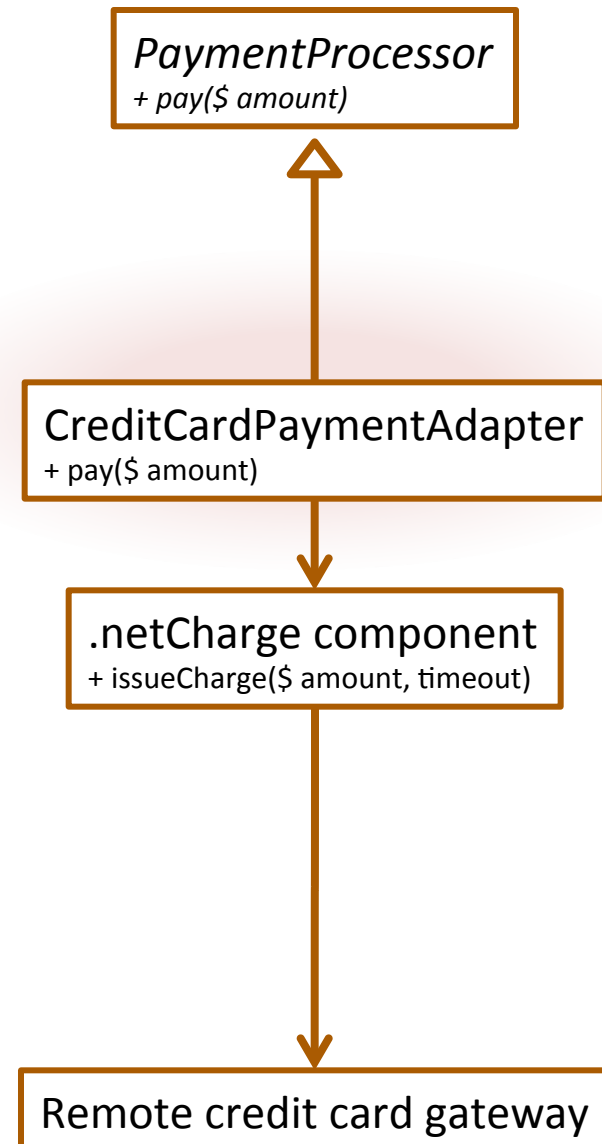
Use when instantiating an object requires filling it with parts or otherwise lengthy configuration



Adapter

Translates one
interface to another
by wrapping

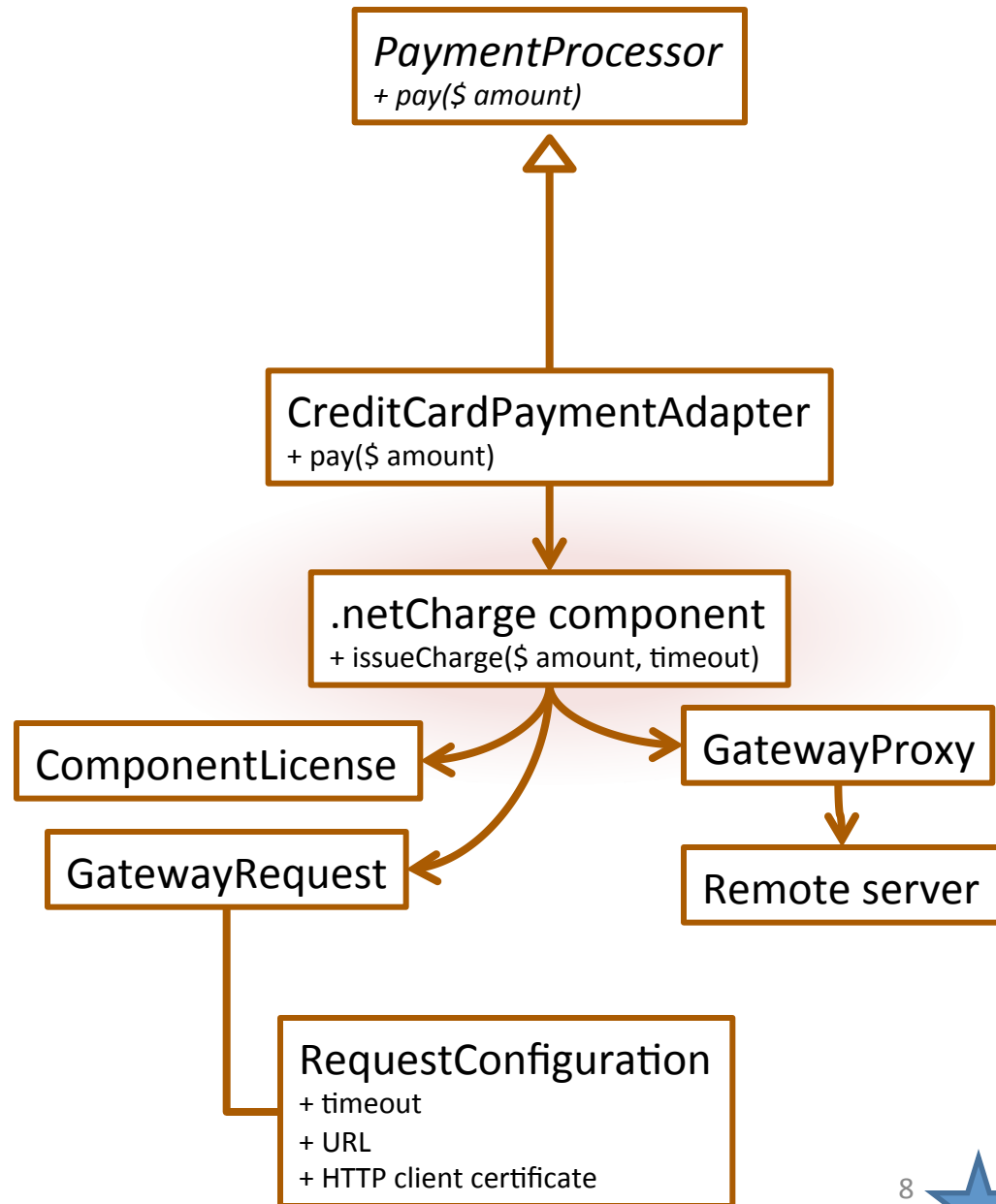
Use to overcome
incompatibility



Facade

Object that provides a unified, high-level interface to a subsystem

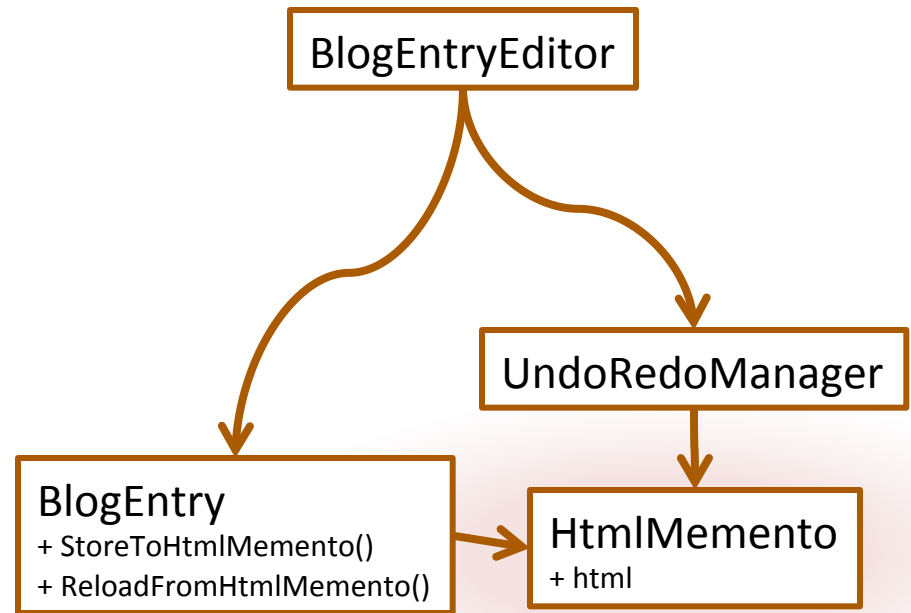
Use when calling a subsystem requires a frequent series of complex lines of code



Memento

Encapsulate state in an object

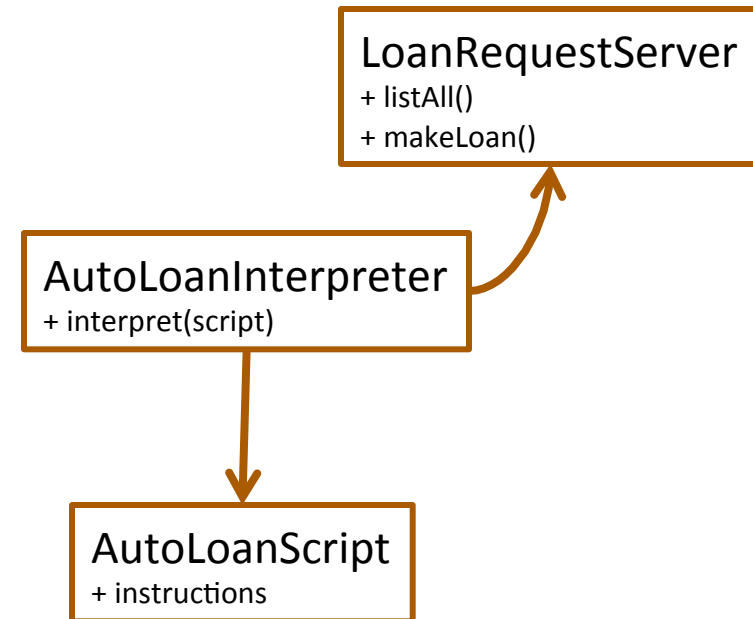
Use if you might want to return to a certain state later



Interpreter

Parses and acts on
instructions written
in a certain syntax

Use to add scriptability

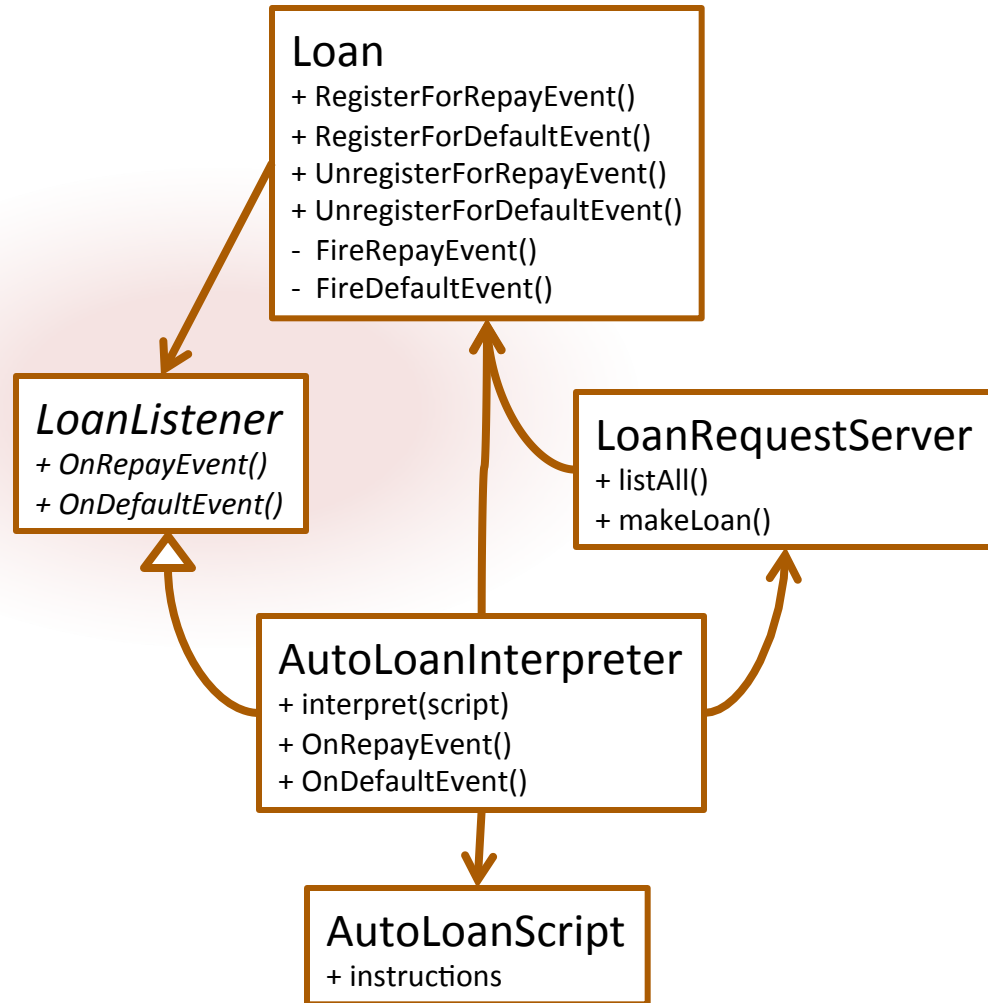


Observer

Watching for another object to change state

Maintains a list of observers and notifies them

Use in any event-driven design



Which Pattern would you use?

- You are building a cool 3D game. Your company licenses a big, ugly library that implements the 3D mathematics.

Builder

Memento

Adapter

Interpreter

Façade

Observer

Which Pattern would you use?

- Your application might crash at any time. You want your application to save its state so that if it crashes, then it can auto-recover.

Builder

Memento

Adapter

Interpreter

Façade

Observer

Which Pattern would you use?

- Your application should run after any student uploads a homework to Blackboard.

Builder

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Façade

Observer

Which Pattern would you use?

- Your application needs to generate PDF files (from scratch).

Builder

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Façade

Observer

Which Pattern would you use?

- You want to let users create and run macros inside your application.

Builder

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Which Pattern would you use?

- Your company already implemented a component that *almost* implements the interface that you need, but *not quite*.

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Which Pattern would you use?

- You have a component that needs to implement three very slightly different interfaces.

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Observer

Which Pattern would you use?

- Your program has to create some big, ugly record objects before inserting them into a database.

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Façade

Observer

Which Pattern would you use?

- Your program has to support replication. You need a way for the program to save its state so the program can be copied to other servers.

Builder

Memento

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Façade

Observer

Which Pattern would you use?

- Your program generates various outputs. You need a way to notify Facebook users when certain outputs are generated.

Builder

Memento

Adapter

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Façade

Observer

Which Pattern would you use?

- Sending a message to Facebook requires lots of big, ugly code.

Builder

Memento

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For More Information ...

- **Your textbook discusses seven other patterns, which we will discuss in next class**
 - Template method
 - Factory method
 - Strategy
 - Decorator
 - Observer
 - Composite
 - Visitor

If You Have Questions ...

- The textbooks discusses a few DPs in detail
- Wikipedia has good articles on all 23 primary DPs
- Email me
- I can set up a class discussion for DPs
- There are many books and articles on DPs