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Object Oriented Design (Reuse)

Week 6-1

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OOP led Reuse

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OOP led Reuse

- Many OOP Lang (Java, .NET)

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OOP led Reuse

- Many OOP Lang (Java, .NET)
  - reuse byte-code (not source code)

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OOP led Reuse

- Many OOP Lang (Java, .NET)
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    - Class Libraries

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OOP led Reuse

- Many OOP Lang (Java, .NET)
  - reuse byte-code (not source code)
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    - Class Libraries
    - Frameworks

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OOP led Reuse

- Many OOP Lang (Java, .NET)
  - reuse byte-code (not source code)
  - reusable software modules
    - Class Libraries
    - Frameworks
    - Components

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OOP led Reuse

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OOP led Reuse

- Another form of reuse

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OOP led Reuse

- Another form of reuse
  - Design Pattern

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OOP led Reuse

- Another form of reuse
  - Design Pattern
  - not concrete implementation...you cannot use it as modules

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OOP led Reuse

- Another form of reuse
  - Design Pattern
  - not concrete implementation...you cannot use it as modules
  - documented form of general rules in prog.

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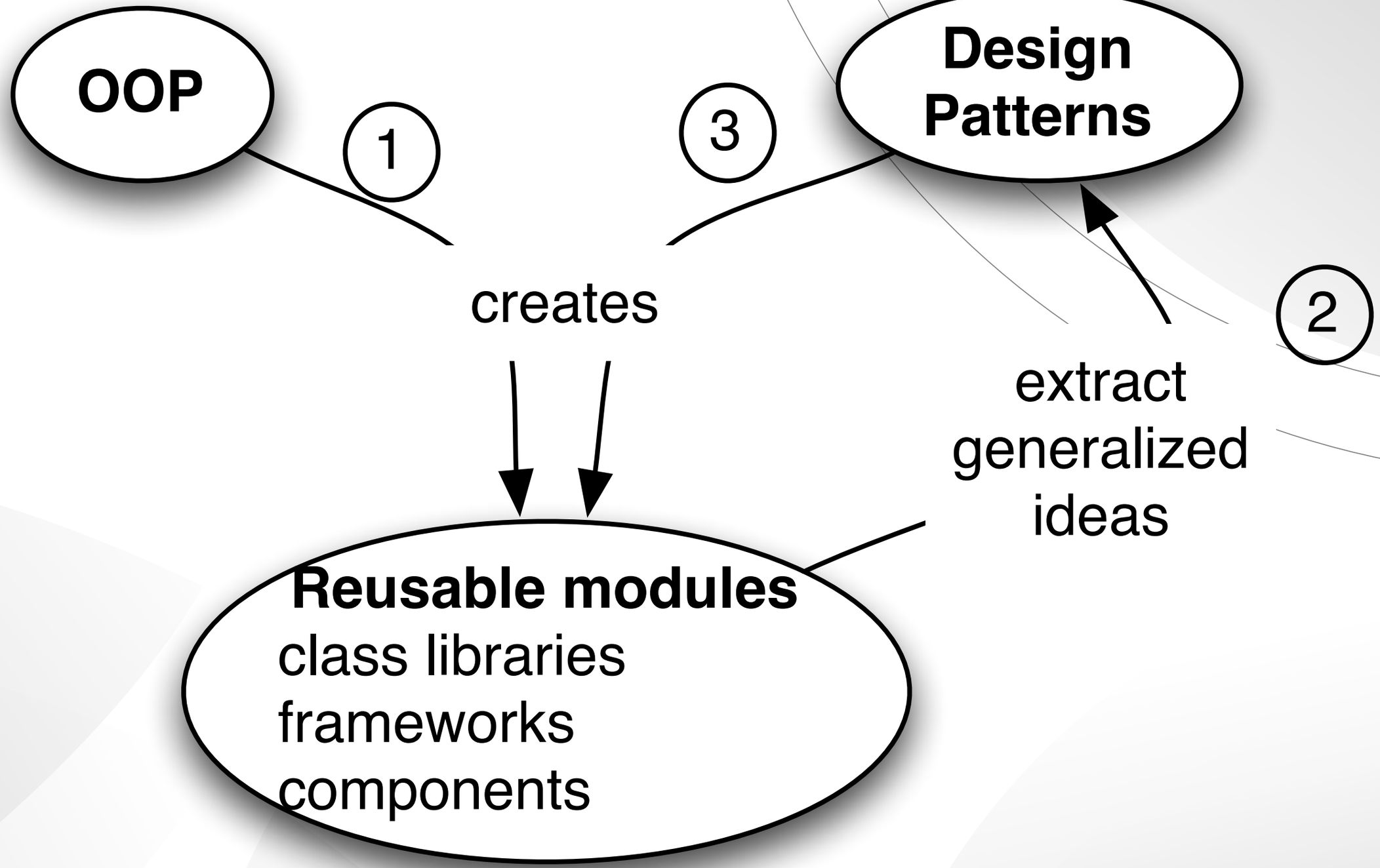

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Class Libraries

- before class libraries
  - function libraries
  - subroutine libraries
- with OOP....class is the basic unit of S.W. modules
  - hence....class libraries
  - but assume the OO-based use.

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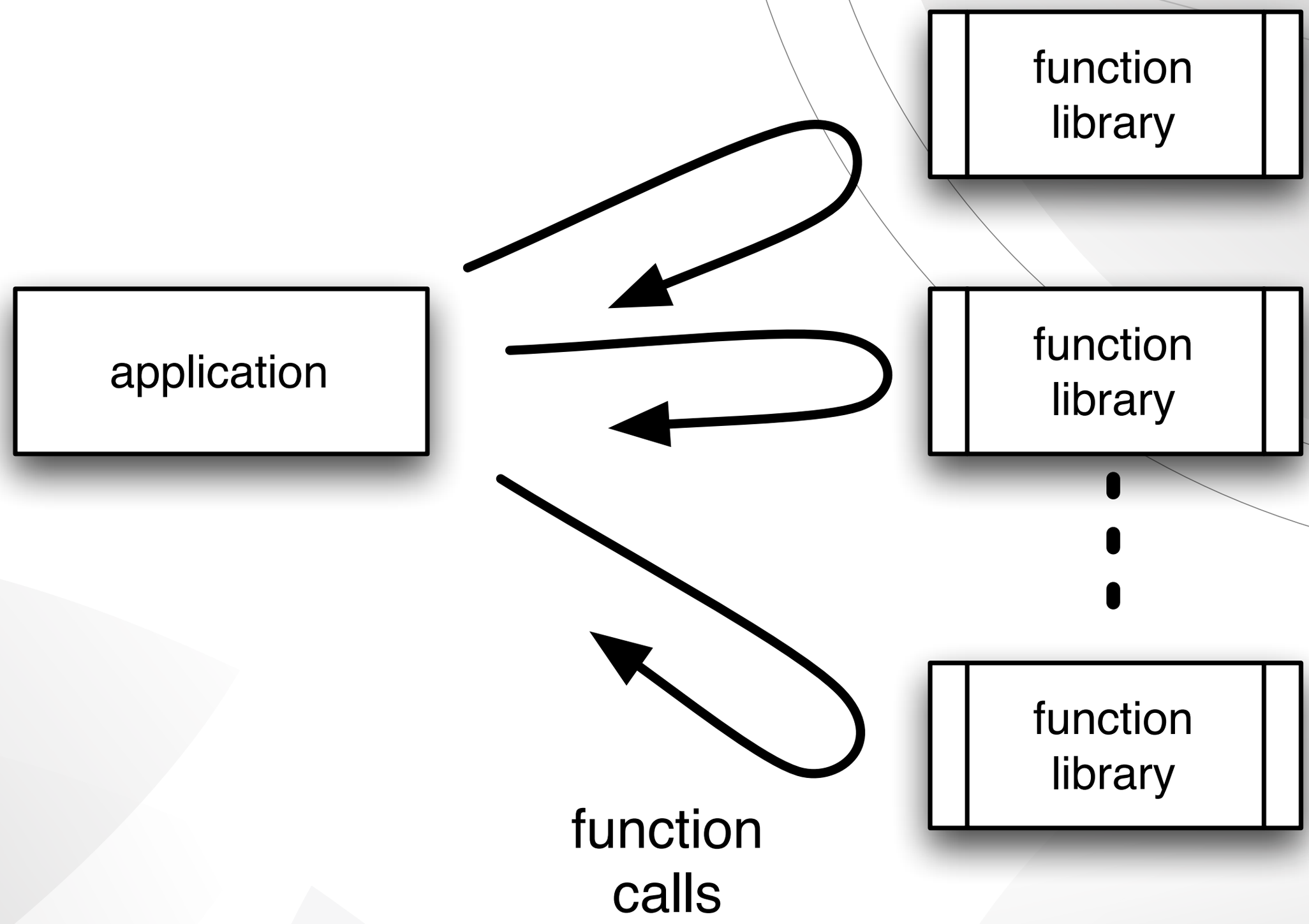

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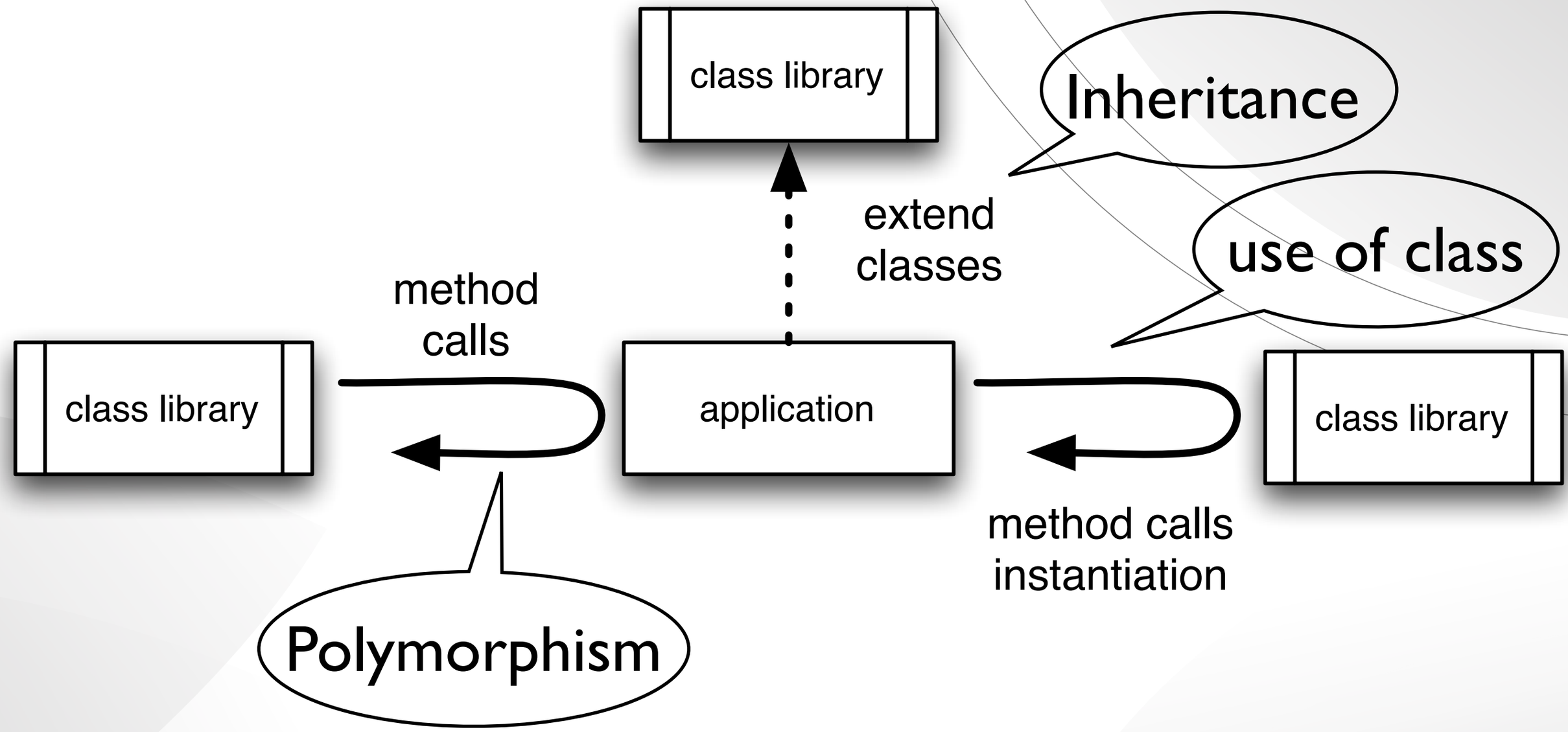

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extending lang.

- function libraries
- class libraries
  - extend prog lang's capabilities
    - not mods to lang spec.

- Java, .NET comes with tons of class libs.
- careful small lang spec updates.

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Framework

- My first encounter...(around 1988).
  - NeXTStep / OPENSTEP frameworks

- Now..everywhere..

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Framework

- similar to class libraries...but
- different in its purpose how they're used.

- class libraries
  - build using OO mechanism
  - do not specify how they should be used and their purposes.

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Framework

- half baked part of an application
- its behaviours have predefined purposes
- how they should be used....defined

- your application will provide concrete/specific logic to fit into the framework.

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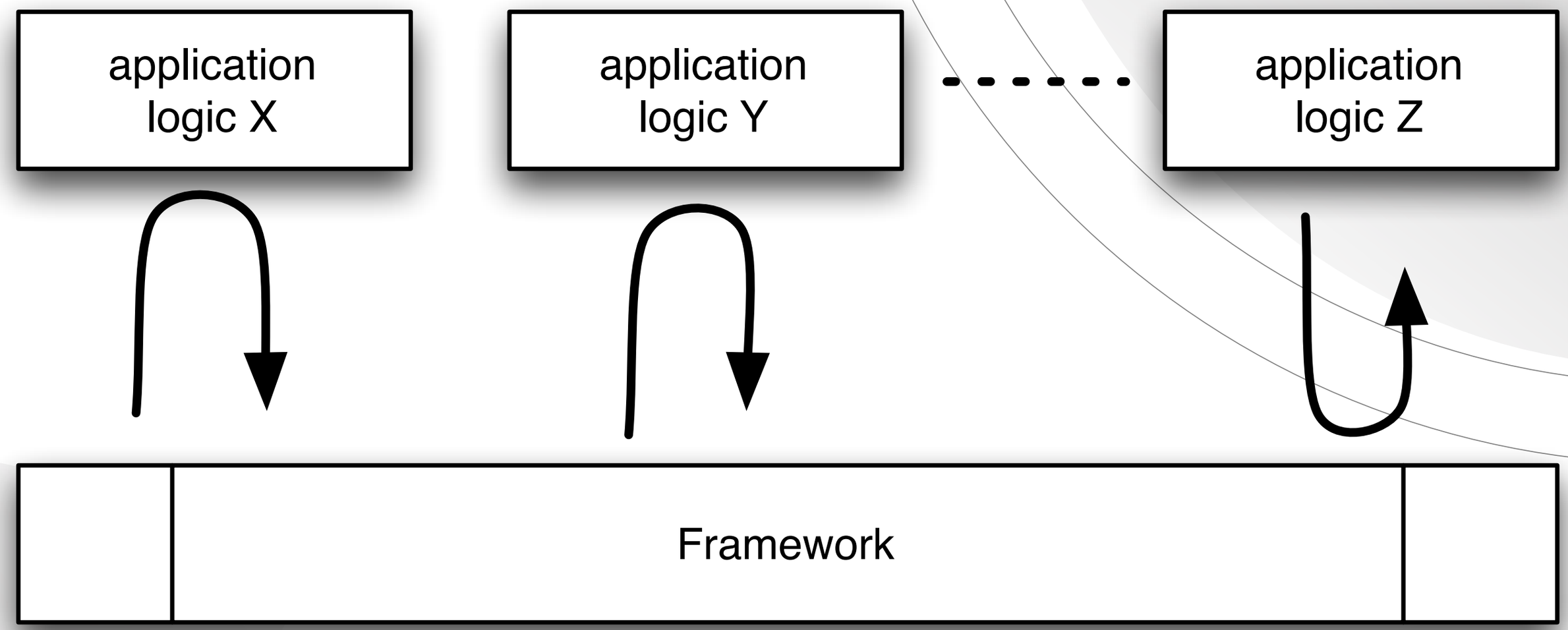

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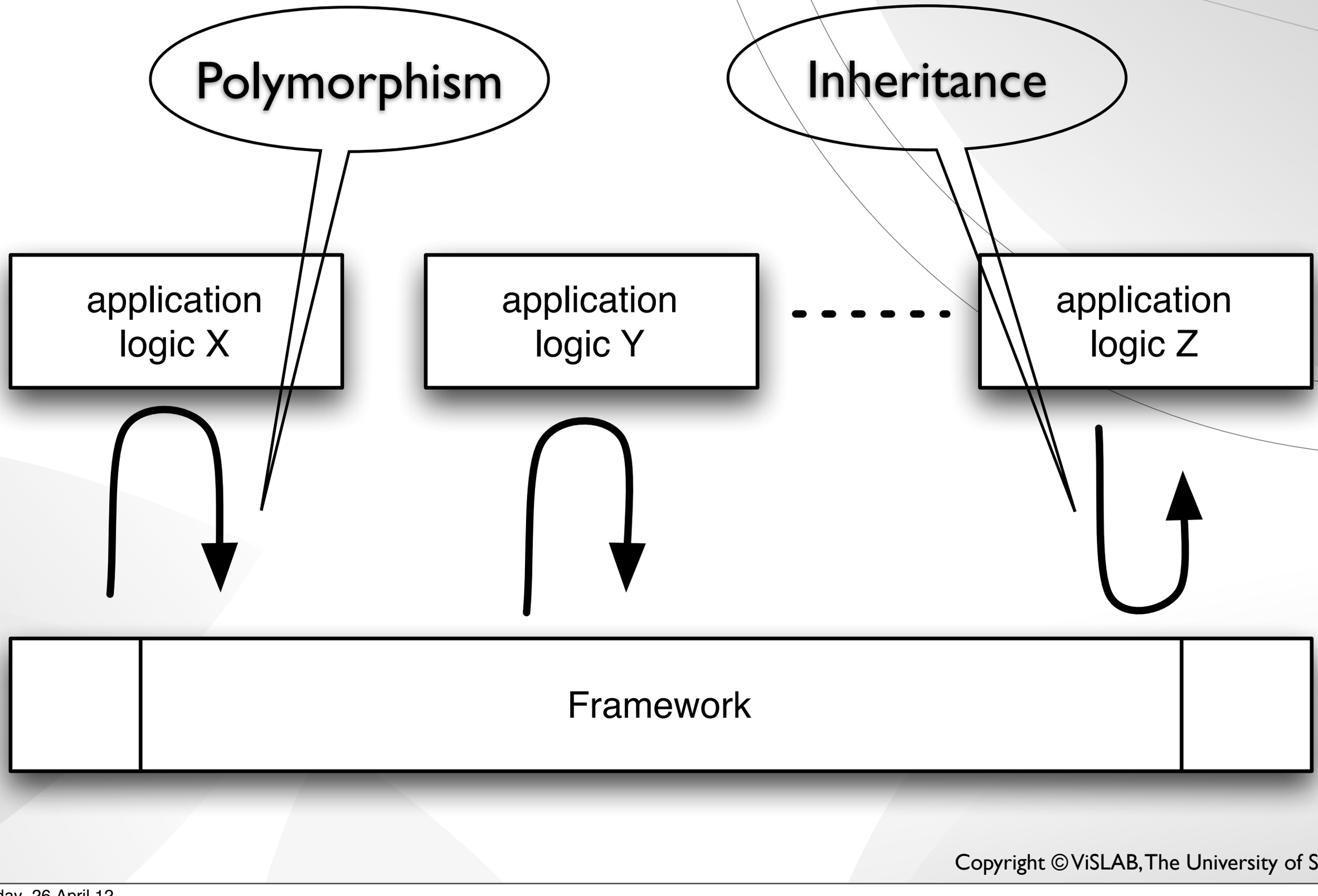
application specific logic



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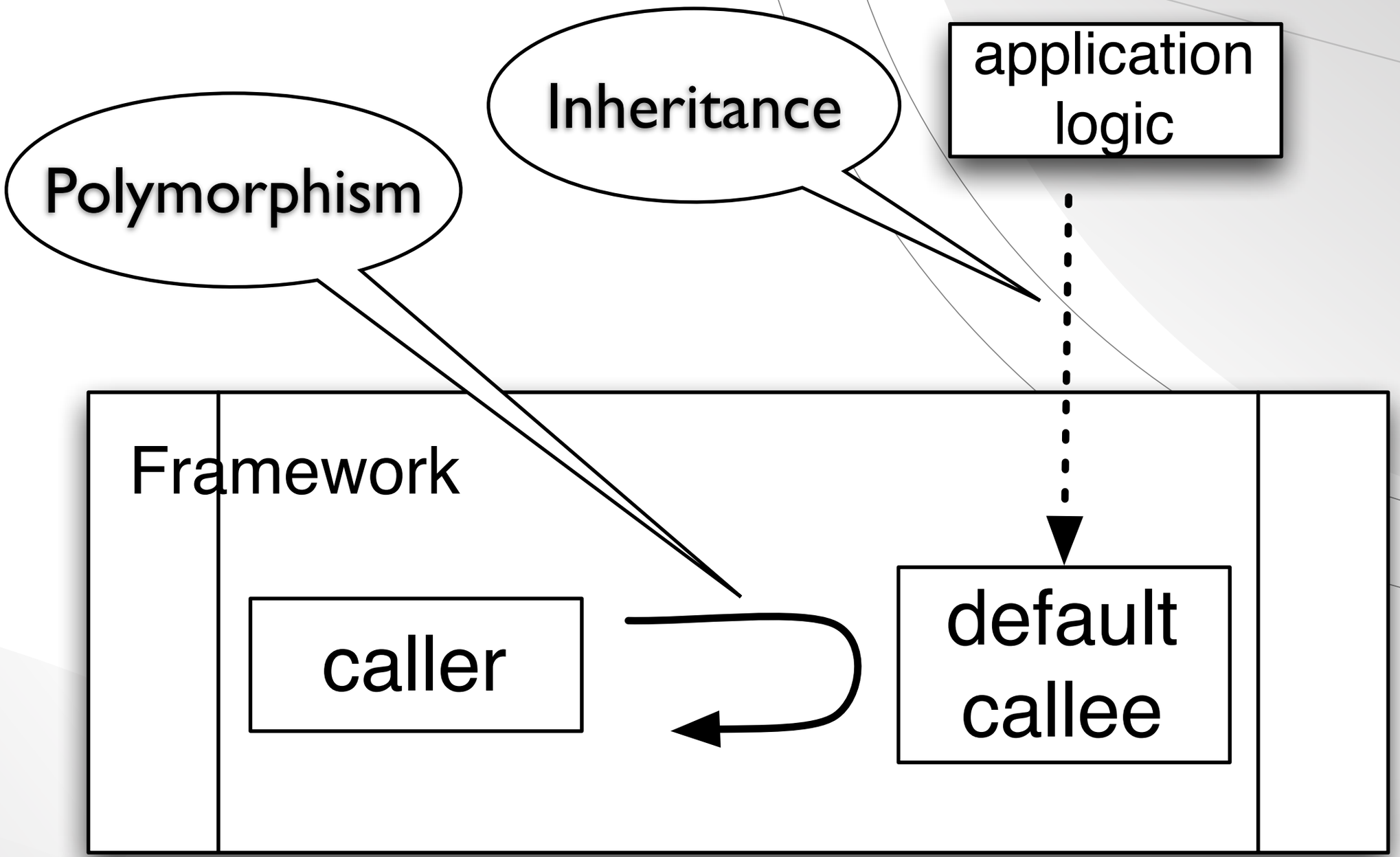

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Framework example

- Java Applet
  - you create a class ..inherits Applet class
  - implement
    - init
    - start, etc.
  - your applet will run in a web page.

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Things to watch out

- duplication of names
  - class names
  - method names
- C++ : namespace
- Java : package

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Components

- more close to "off the shelf" modules
- typically distributed in binary forms (including bytecode)
- larger granularity
- self-contained
- no need for internal details, etc.

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Component examples

- JavaBeans, Enterprise JavaBeans
  - deployable java components
  - independently developed
- Visual Basic's control components (GUI)
  - supports drag&drop

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Components

- usually see where you can distribute executable modules.
  - Windows : proprietary environment
  - Java, .NET: cross-platform, bytecode
  - C++: ?

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Design Patterns

- building
  - class libraries, frameworks, component libraries.....
- realise that there are many COMMON WAYS to build reusables
- regardless of platforms/dev. environment.

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Design Patterns

- are not
  - a set of sourcecode
  - a set of pre-compiled executables
- are
  - WRITTEN document describing how you could design software modules/systems

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Design Patterns

- originates in
  - Architectural Design Concept
  - Christopher Alexander
  - *A Pattern Language: Towns, Buildings, Construction* (1977)
  - *The Timeless Way of Building* (1979)

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Design Patterns

- does not tell you how to implement in a particular OOP lang.
  - may have reference implementation.

- "Design Patterns" (1995)
  - Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides
  - GoF (Gang of Four)

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Creational		
	Abstract Factory	generation of related components
	Builder	build a complex instance
	Factory Method	delegate instance creation to a subclass
	Prototype	create an instance by copy
	Singleton	only one instance

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Structural		
	Adapter	use over a wrapper
	Bridge	separate functional hierarchy and implementation hierarchy
	Composite	recursive container and components
	Decorator	recursive decorator and decoratee
	Facade	provide a simple entry point to interact with many
	Flyweight	minimise resource wasting through sharing
	Proxy	act on behalf of ...

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Behavioral		
	Chain of Responsibility	keep delegating
	Command	oder something to objects
	Interpreter	represents grammatical rules
	Iterator	count/visit one by one
	Mediator	provide a unified consultation point
	Memento	keep object's status for later use.
	Observer	notify the change of state

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Behavioral		
	State	represent “status” using class
	Strategy	replace an entire algorithm depending on....
	Template Method	delegate actual process to subclasses
	Visitor	do something by acting/ visiting on a series of objects

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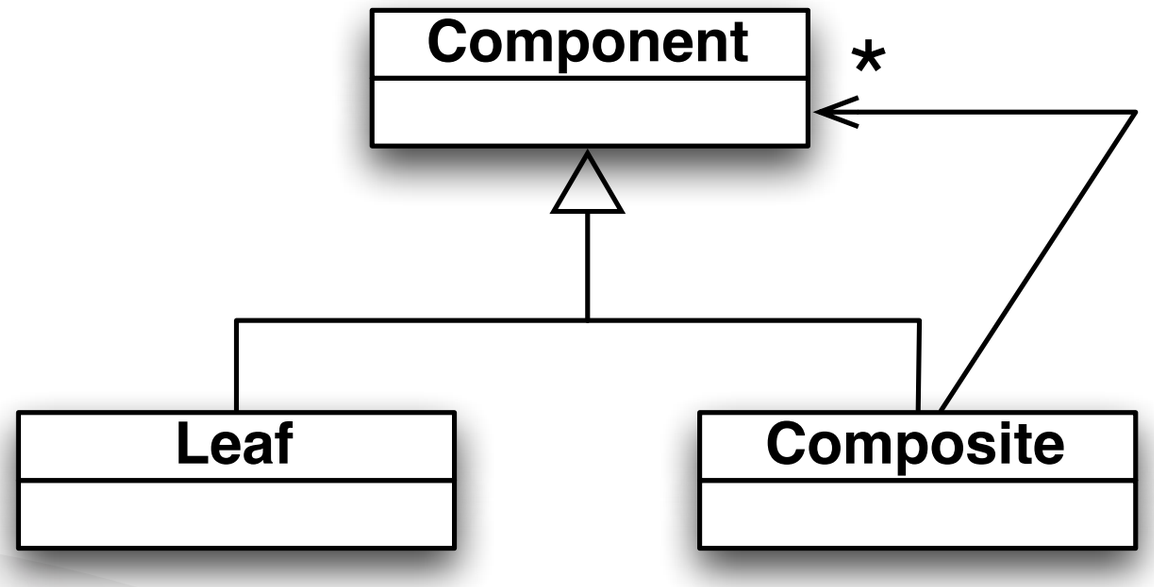
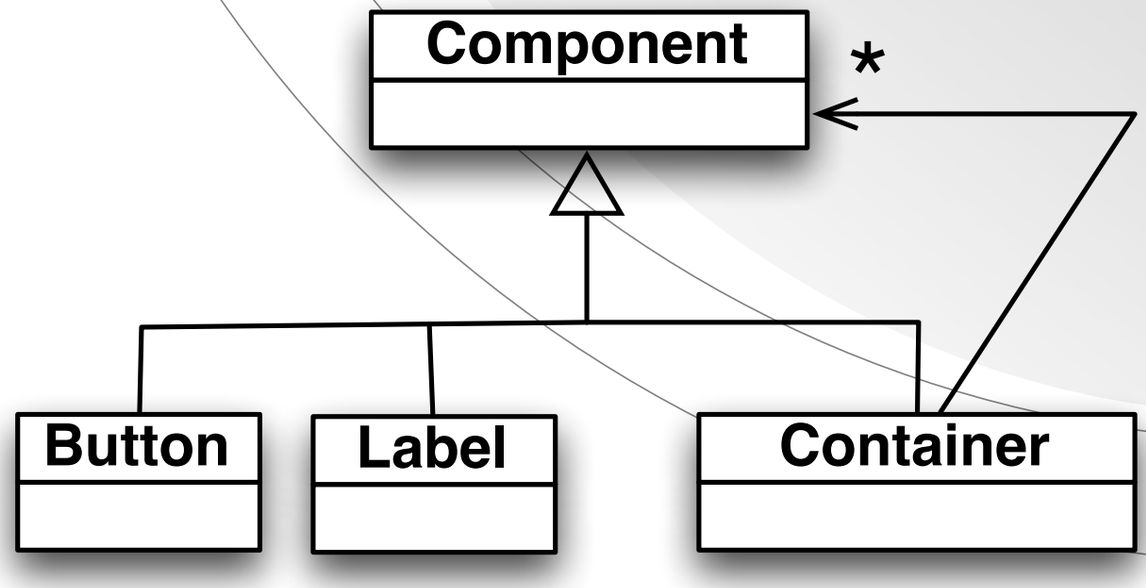
example



Composite Pattern



java.awt package

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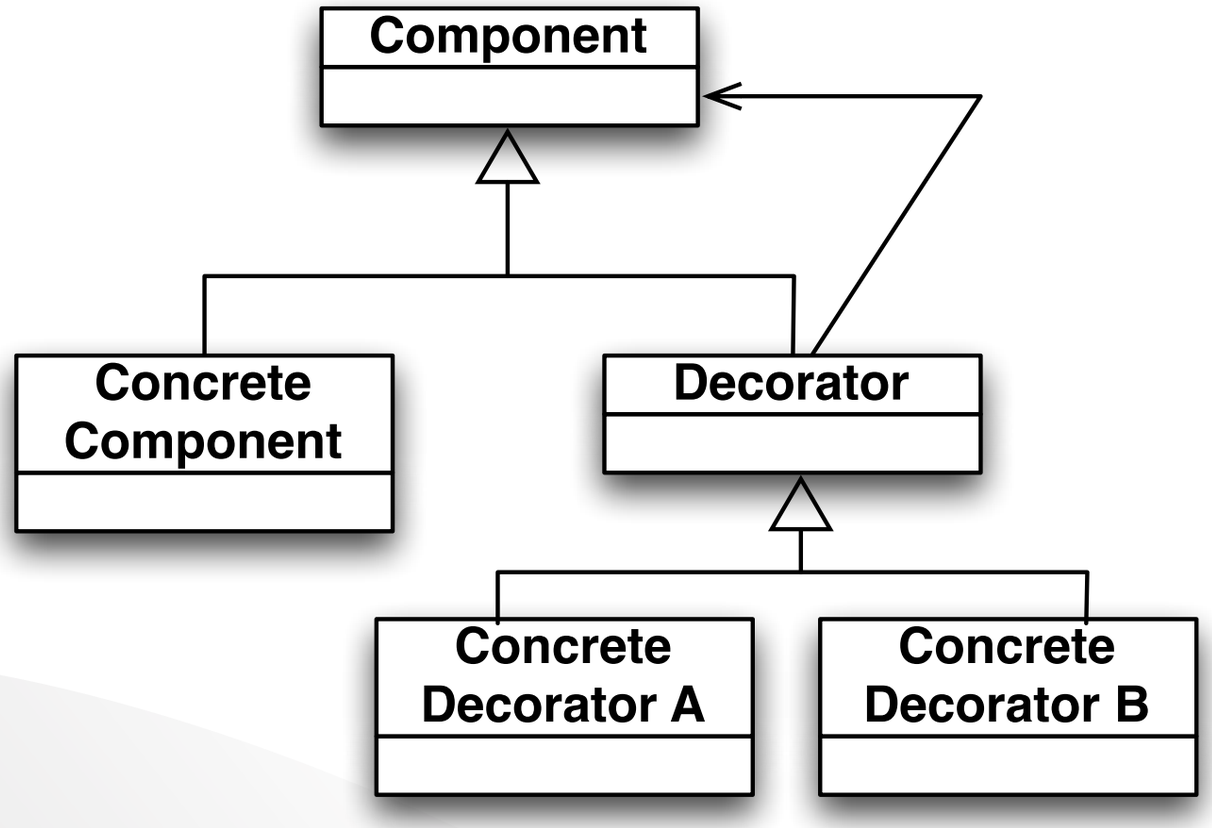
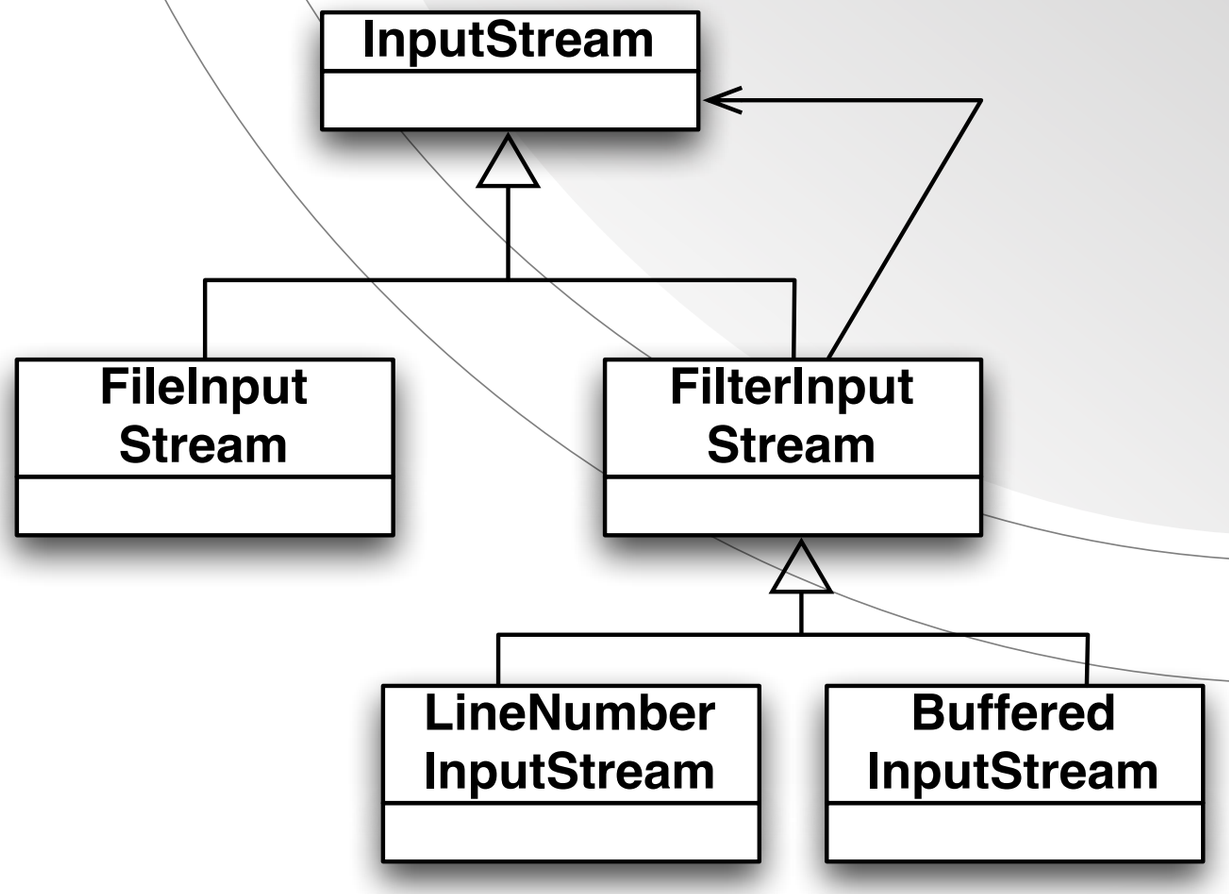
example



Decorator Pattern



java.io package

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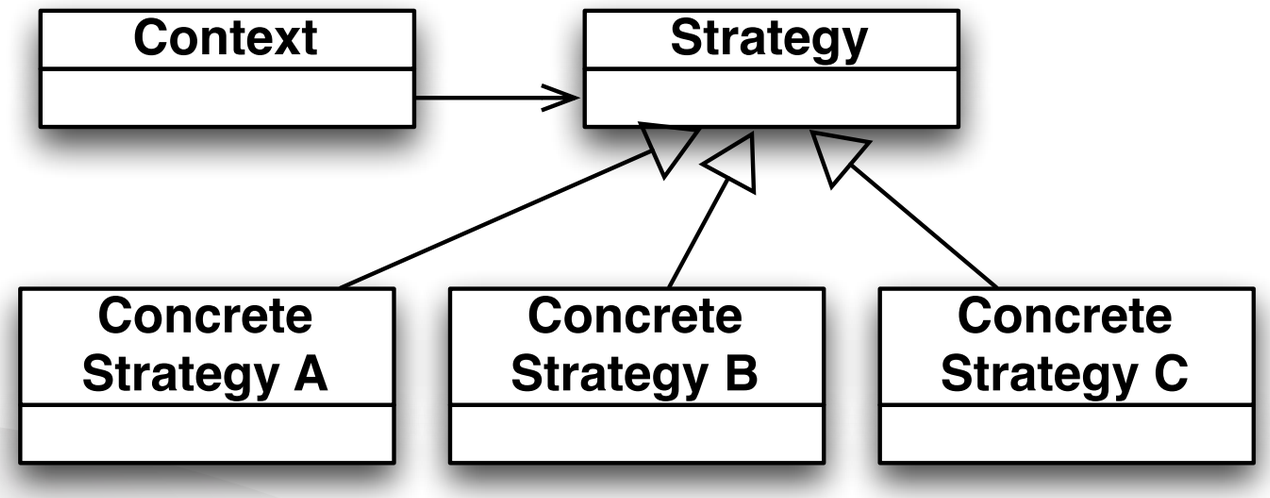
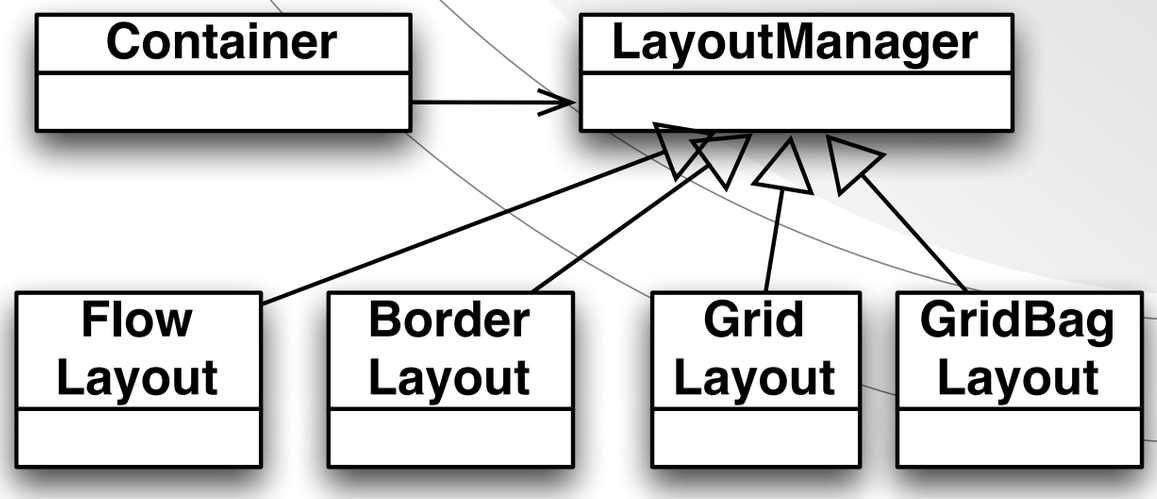
example



Strategy Pattern



Java.awt package

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Some class has names of pattern

- Iterator
- Observer, etc.

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There are may patterns

- GoF...Design Patterns has 23 patterns...but
- there are more...and may be more..

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learning patterns

1. associate
   - “Pattern Name”,
   - “its purpose”,
   - “form” (structure...UML)
2. use them to study others’ work (library/ frameworks, etc)
3. use them for your own design
4. use to exchange ideas with others

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- D.P originates in Architectural Patterns
- C.S. has
  - named data structures and algorithms
    - list, linked-list, stack, heap
    - binary search, quick sort, bubble sort,...
- but D.P is more sophisticated
  - based on OO.

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Other Patterns

Name	Description
Specific D.Ps.	J2EE pattern, EJB pattern, multithread pattern, etc
Analysis	system analysis, requirement analysis describe problems
Architectural	Overall software/system structure
Idiom	P.Lang techniques
Refactoring	change internal without changing funcitonality
Process	System dev. process patterns
Anti patterns	list of don't do it!

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Use D.P. to be Lazy but High Quality Code

- appropriate use of D.P. will allow you to
  - write less code
  - build re-usable modules
- all happening at Design Stage!

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