Frameworks

A key claim by proponents of OO Software is that it increases reusabilty.
How?

Old days: Subroutine Libraries

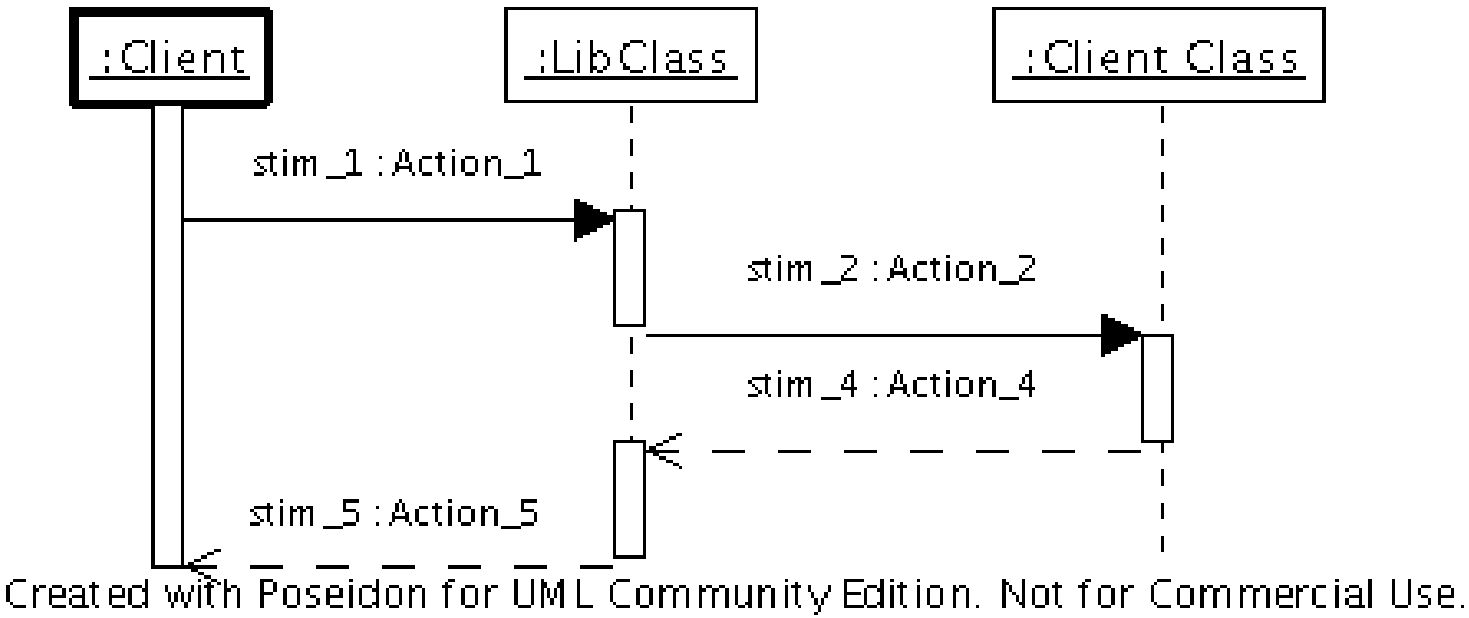
- A library is a collection of useful subroutines.
- Little extensibility/customizability.
- *Callbacks* possible:

```
#include "integration.h"
// integration.h declares:
// double integrate(double, double, double*(double))

// A local function
double myFunc(double x) { sin(exp(x)); }

// A call to a library routine
double area = integrate( 0.0, b, &myFunc );
// Library routine calls back to myFunc.
```

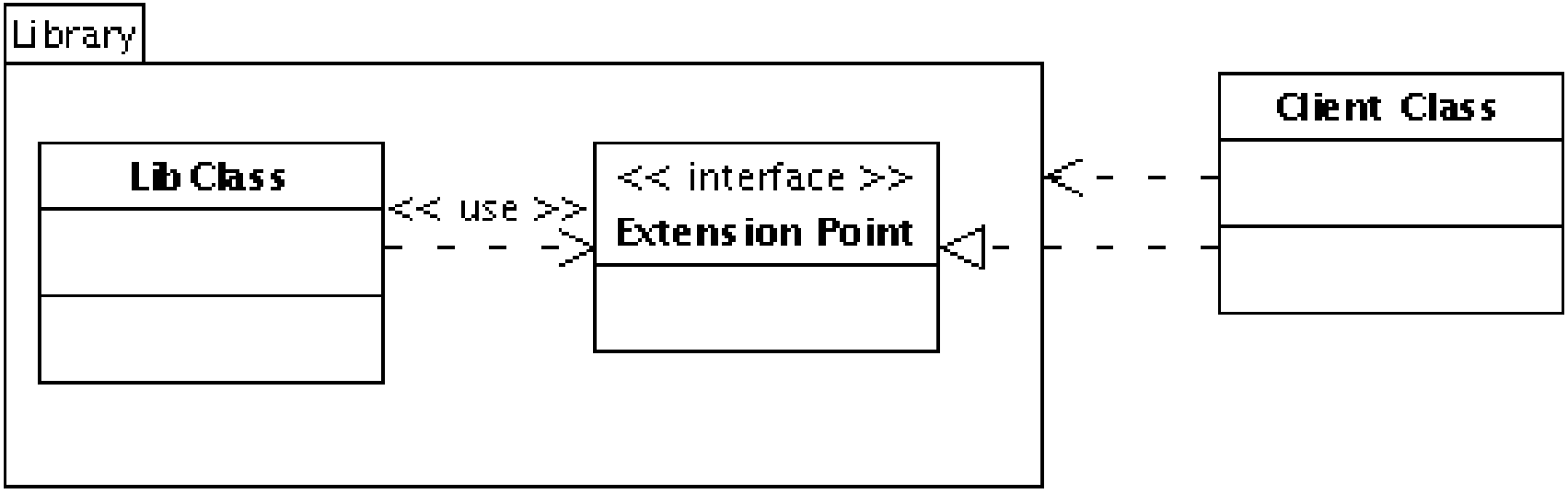
OO Days

- Simple libraries are collections of concrete classes.
  - Library objects are at a low level only.
- *Frameworks* are collections of concrete classes, interfaces and abstract classes such that
  - the library classes routinely call back to client level code
  - Abstract classes, concrete classes and interfaces intended to be specialized or realized by client code are called *Extention points*
  - Client objects may be used by library objects

Framework Secquence Diagram



Framework Class Diagram



Application Frameworks

- Incomplete applications
- Client code completes the application

Example: Document/Editor Framework

- Many applications are basically editors
- Functionality of the File menu is essentially the same.

(See javax.swing.text.EditorKit and javax.swing.text.Document for a similar example.)

Extension Point: Document

```
abstract class Document {
  abstract public void writeTo(Writer w)
    throws IOException;
  abstract public void readFrom(Reader r)
    throws IOException;
  public save() {
    ... writeTo( w ); modified = false ; ...}
  public open() {
    ... readFrom( r ); modified = false ; ...}
  public void setModified() { modified = true; }
  public boolean getModified() { return modified; }
  public void setFile(File f) { file = f; }
}
```

Extension Point: EditorComponent & AbstractFactory

```
abstract class EditorComponent extends Component {
  abstract public void setDocument(Document e);
  abstract public Document getDocument();
  abstract public void AddMenus( MenuBar b );
}

interface AbstractFactory {
  Document makeDocument();
  EditorComponent makeEditorComponent();
}
```

Document Editor Framework

The Framework code

- Is parameterized by an AbstractFactory
- Handles New, Open, Close, Save, Save As, Print, and Exit actions.
- Also actions on Frames such as resize, minimize, move, close, etc (mostly inherited from Frame).

Parameterization

```
class DocEditorFrameWork {
  // Constructor
  DocEditorFrameWork(AbstractFactory f) { ... }
  ...
}

class Main {
  static public void main( ... ) {
    ...
    new DocEditorFrameWork( new Factory() );
    ...
  }
}
```