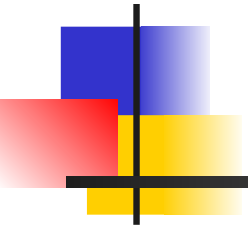


Frameworks

Reusable Software

Frameworks are ...

- a reusable application or environment that can be modified by addition of application-specific code, *without modifying the framework* code.
- frameworks provide a reusable *architecture*, not just reusable code.

Examples

Java Collections Framework

- you can use it to create custom collections that reuse the base collections logic and interfaces

Web Frameworks

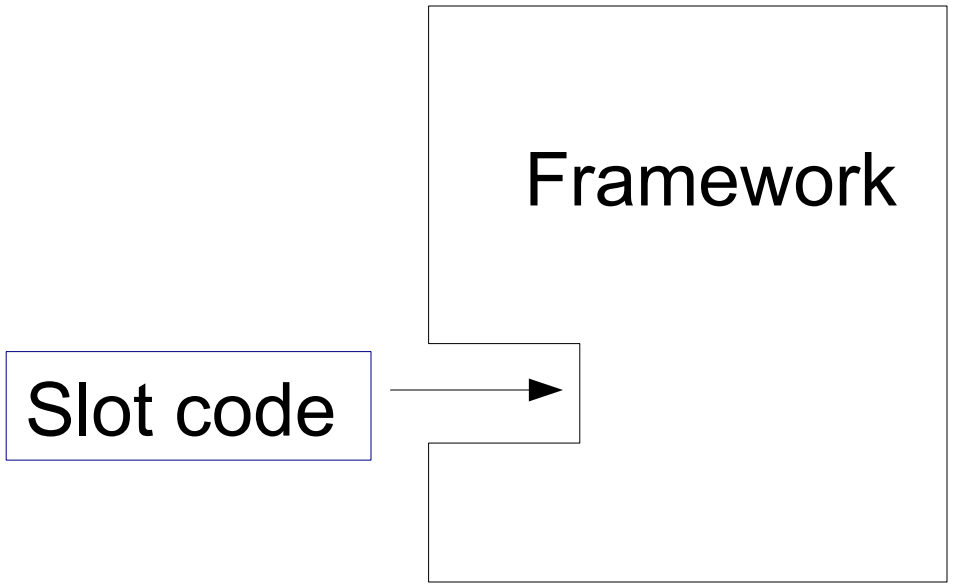
- provide logic and architecture for request mapping, session management, database access, and more.
- Spring Framework, Struts2, Play (Java)
- Django (Python)
- Rails (Ruby)
- Symphony, CakePHP, Lavarel (PHP)

JUnit testing framework

"Slots": Required Customization

Many frameworks require you to add some code before they can be used.

Some people call these slots.



Slot can be a class or a method.

Object Client-Server Framework

OCSF is a TCP-based client-server framework.

Client Side:

connects to server

sends messages to server

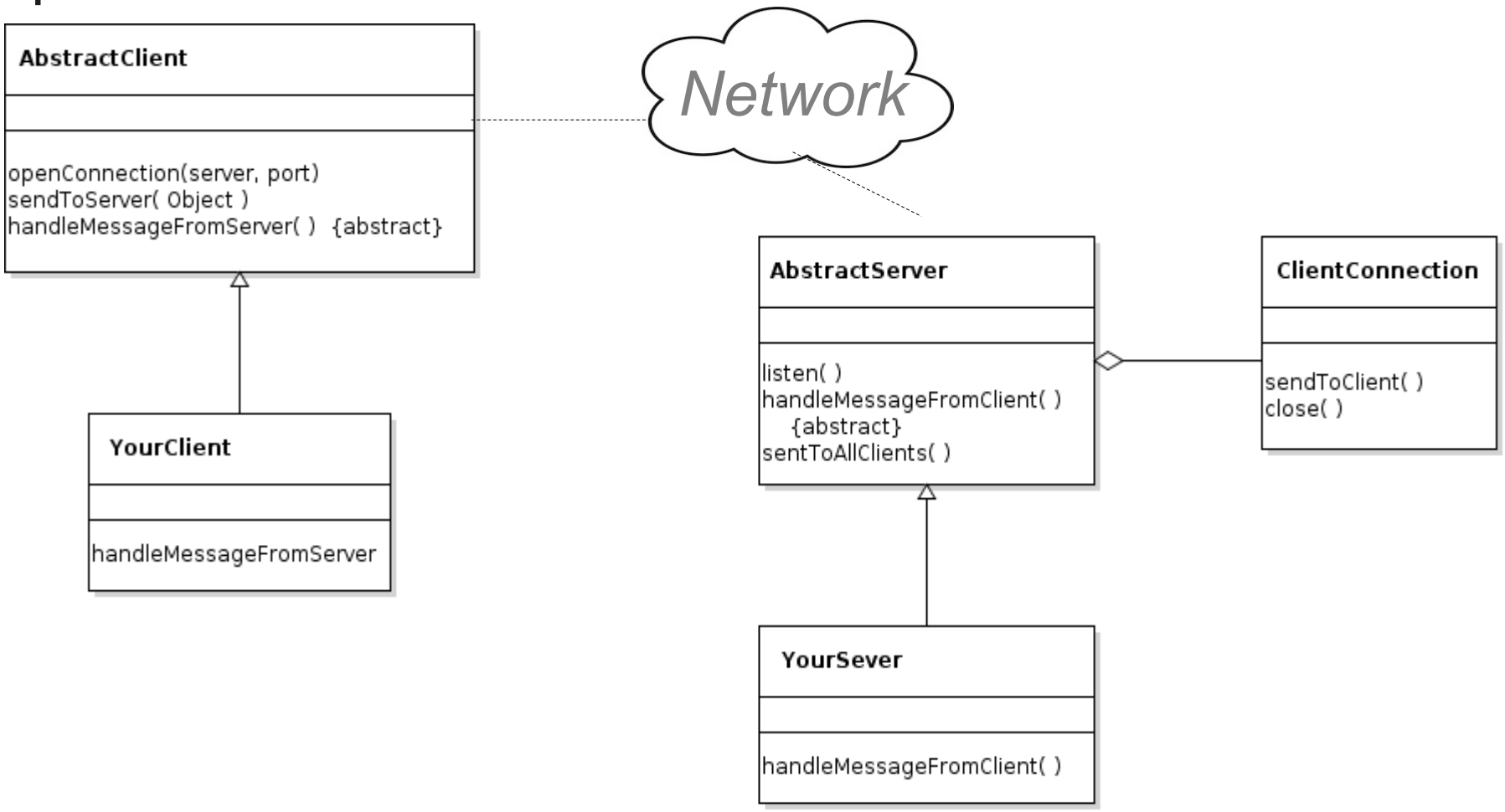
receives message from server

handles connect & disconnect events

Server Side:

- *manage connections from clients*
- *receive messages from clients*
- *send messages to clients*

OCSF


AbstractClient
openConnection(server, port)
sendToServer(Object)
handleMessageFromServer( ) {abstract}
Network
AbstractServer
listen( )
handleMessageFromClient( )
{abstract}
sentToAllClients( )
ClientConnection
sendToClient( )
close( )
YourClient
handleMessageFromServer
YourSever
handleMessageFromClient( )

"slots" are usually *callbacks*

A callback is a method in your code that the framework invokes. You *start* the framework, then it *calls you back* when an event occurs.

This is also called inversion of control.

You start the framework, then it takes control.

In OCSF, the required *callbacks* (slots) are:

Client: `handleMessageFromServer`

Server: `handleMessageFromClient`

That's it! You can write a network client-server application just by writing 2 methods.

Code Reuse, Architecture Reuse

OCSF provides the architecture and code for a TCP client-server application.

You can use the framework without knowing *how* it works

(or how TCP works).

- but you should study OCSF to learn how to use networking in Java.

You can *modify* and *extend* the framework by overriding callbacks (slots and hooks).

OCSF AbstractClient

```
<<controls>> (commands to the framework)
  openConnection( )
  sendToServer( Object )
  closeConnection()
<<hooks>>    (optional callbacks)
  connectionEstablished( )
  connectionClosed( )
  connectionException( )
<<slot>>     (required callbacks)
  handleMessageFromServer( Object )
<<accessors & mutators>>
  isConnected()
  getPort( ), setPort(port)
  getHost( ), setHost(server)
```

OCSF AbstractServer

```
<<controls>> (commands to the framework)
  listen( )
  stopListening( )
  sendToAllClients(Object msg)
<<hooks>>    (optional callbacks)
  clientConnected( )
  clientDisconnected( )
  several others
<<slot>>     (required callbacks)
  handleMessageFromClient( Object )
<<accessors & mutators>>
  isListening()
  getClientConnection(int id)
  getPort( ), setPort(port)
```

Example

A messaging client that sends strings (message).

All clients receive the message.

Use port 5050 (port > 1024 is suggested for Linux and MacOS).

Client side

- Extend AbstractClient & implement the callback method

```
import com.lloseng.ocsf.client.AbstractClient;
public class ChatClient extends AbstractClient {
   public ChatClient(String host, int port) {
     super(host, port);
    }

   @Override
   protected void handleMessageFromServer(Object msg)
   {
     System.out.println("> " + msg);
   }
}
```

Run the client

1) Create a client with server (host) name and server port.
2) Connect to the server.
3) In a loop...
    1) wait for user to type a message
    2) send message to server

TODO: provide a way to quit

Server Side: an Echo Server

- Create a server that just echoes messages to all client.
- Extend AbstractServer. Override the "slot" method.

```
public class EchoServer extends AbstractServer {

   /** create a new echo server */
   public EchoServer(int port) {
      super(port);
   }

   @Override
   protected void handleMessageFromClient(
         Object msg, ConnectionToClient client) {

      super.sendToAllClients(msg);
   }
```

Running the Server

```
private static final int PORT = 5555;

public static void main(String[] args) {

   EchoServer server = new EchoServer(PORT);
   try {
      server.listen();
      System.out.printf("Listening on port %d\n",
                        PORT);
   } catch (IOException e) {
      System.out.println("Couldn't start server:");
      System.out.println(e);
   }
}
```

Using Hooks

Server:

print a message when a client connects or disconn.

Client:

print a message if server closes the connection.

What hooks (callbacks) can we should use to do this?

How OCSF Works

You don't know *how* a framework works in order to use it.

This is the advantage of a framework; it provides an abstraction for what you want to do.

Think "value added" … don't waste time re-inventing logic and architecture that has been done already.

TCP is Connection Oriented

In TCP, a server listens for connections on a *port number*.

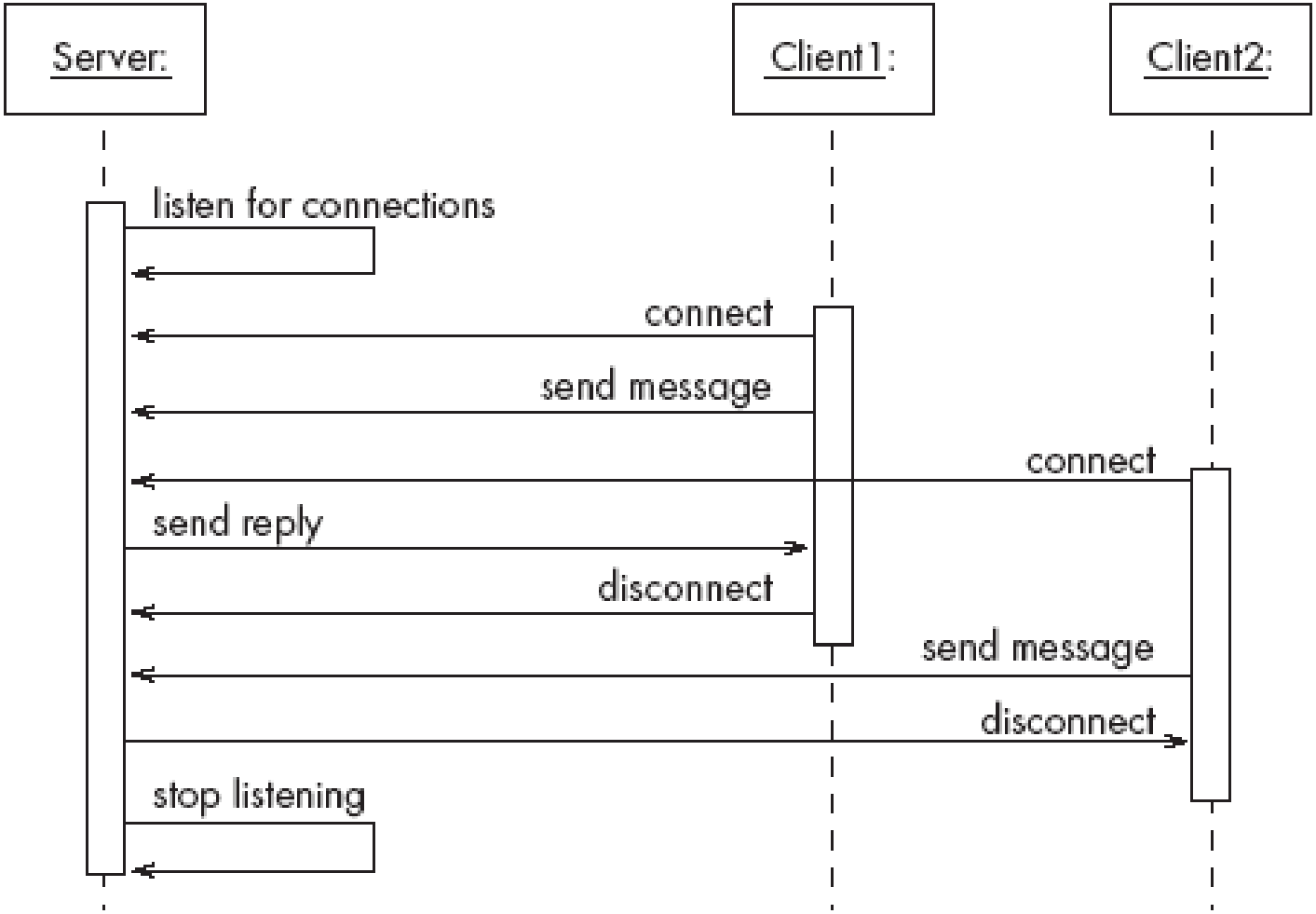
A client connects using server's IP address and port number.

Either side can send messages.

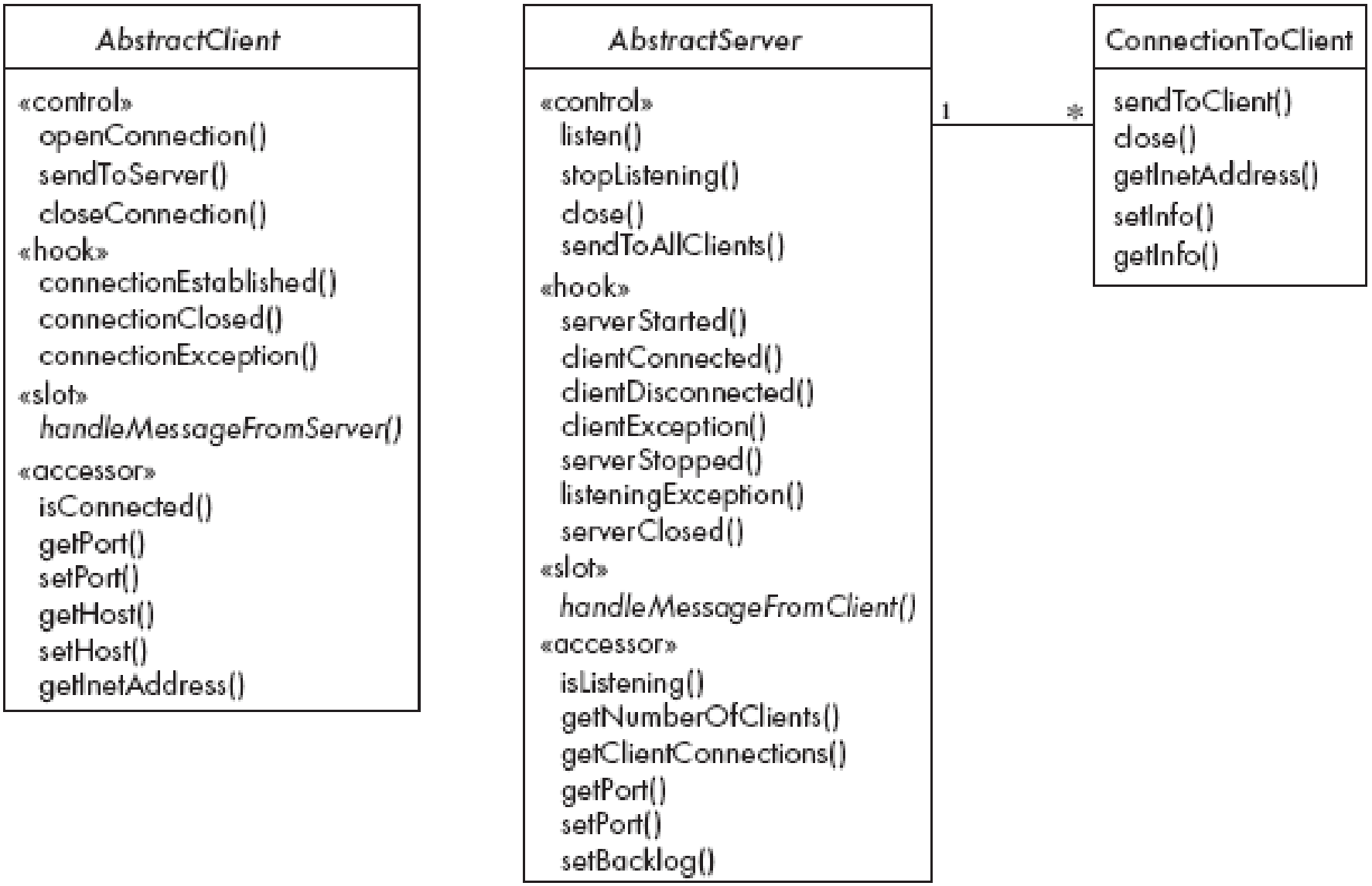
A server can accept *many connections* on the same port.

When a client connects, the server creates a *new thread* to handle communication with one client.

TCP Example


Server:
Client1:
Client2:
listen for connections
connect
send message
connect
send reply
disconnect
send message
disconnect
stop listening

OCSF's Main Classes



The Client Side

AbstractClient m*ust* be subclassed

- Any subclass must provide an implementation for handleMessageFromServer
  - Takes appropriate action when a message is received from a server

Implements the Runnable interface

- Has a run method which
  - Contains a loop that executes for the lifetime of the thread

The public interface of AbstractClient

Control methods (you can call these, but don't override)

- openConnection
- closeConnection
- sendToServer

Status and Accessor/Mutator

- isConnected
- getHost
- setHost
- getPort
- setPort
- getInetAddress

Callback methods of AbstractClient

Callbacks that *may* be overridden:

- connectionEstablished
- connectionClosed

Callback that *must* be implemented:

- handleMessageFromServer