Purpose	Learn to apply a framework in developing an application
Files	Download the ocsf-231.jar to your project directory (or anywhere). Project JAR dependencies are usually put in a **`lib/`** directory. Add **`ocsf-231.jar`** to your project.

Overview

The purpose of this lab is to practice using a framework. OCSF is a simple framework that provides TCP-based client-server connections.

Without the framework, we would need several labs just to implement network communication.

A framework reduces development time and usually improves software quality. Most frameworks are extensively tested both by developers and users, so they have fewer bugs and a better architecture than software written from scratch.

Using OCSF

The Object Client-Server Framework (OCSF) provides client-server communications using TCP/IP.

The OCSF framework is described in a textbook by Lethbridge (chapter on OCSF is on class web).

Writing a Console-based Client

A client extends the OCSF AbstractClient (or ObservableClient) class.

An OCSF client must at least do this:

1. Provide a constructor with 2 parameters that calls the superclass constructor.

```
public class MyClient extends AbstractClient {
    public MyClient(String hostname, int port) {
        super(hostname, port);
    }
```

2. Implement the abstract "slot" (callback) method `handleMessageFromServer`.

```
public void handleMessageFromServer(Object message) {
    // do whatever your application wants with the message
    System.out.println( message.toString() );
}
```

3. Open a connection to the server, somewhere in your app.

```
    MyClient client = new MyClient( hostname, port );
    client.openConnection();
```

4. When you have a message you want to send to the server, call `sendToServer`:

```
    // console is a Scanner object that reads System.in
    String msg = console.nextLine( );
    super.sendToServer( msg );
```

Problem 1: Write a Client that connects to server and sends Strings

You can write a console-based client or GUI client

Create a client as a subclass of AbstractClient or ObservableClient. that does this:

a) Connect to the server and display a "connected" message.

b) Show any messages from the server. Print on console or display in a GUI field.

c) Accept input from the user and send it to the server.

d) Close the connection when you want to quit. If you write a GUI, there should be a "Disconnect" button. On the console, if the user enters "quit" then disconnect.

Example:

```
Connected to server 158.108.32.99    <-- message from your program
> Hello. Please Login                <-- message received from server
Input:  Login Fataijon               <-- send "Login yourname"
> Hello Fataijon.  What is 8 & 12        (Prove you are a programmer)
Input:  8
> Correct!   What is 8 ^ 12               (These are bitwise operations)
Input:  12
> Sorry, wrong answer.
Input: 4
> Correct!
Input: quit
Disconnected.
```

Steps:

1.1 Create a Java project in your IDE.

1.2 Add ocsf-231.jar as a JAR file to the project.

1.3 Write a ConsoleClient as subclass of AbstractClient or ObservableClient. Write the required constructor.

```
public class ConsoleClient extends AbstractClient {
   public ConsoleClient(String hostname, int port) {
      super(hostname, port);
   }
```

1.4 Write handleMessageFromServer(Object object). Print the message on console or in a window (for GUI client).

1.5 Write a method to run in a loop until user quits. Read input lines and send them to server. The method you write in the previous step will print messages from the server.

```
public void consoleDialog() throws IOException {
       openConnection();
       // loop until user quits
       while( isConnected() ) {
              // read the user's input text and send it to server
        }
}
```

handleMessageFromServer(Object object) - print it on the console

1.5 Write a main method. Create objects and start the console dialog (or GUI dialog).

```
public static void main() {
     ClientConnection client = new ClientConnection(servername, port);
     //TODO add try - catch for IOException
     client.consoleDialog();
```

See the Javadoc (in ZIP file) for details of using the methods.

Callback Methods (the framework calls your code)

The framework has several *callback methods* that you can ***override*** in your client class (a subclass of AbstractClient or ObvervableClient). The framework calls these methods when an event occurs. These methods are how you use the framework to provide functionality to your app.

`handleMessageFromServer`	(**required**) this method is invoked whenever the client receives a message from the server
`connectionClosed( )`	(optional) this method is invoked if the connection to server is closed.
`connectionEstablished()`	(optional) this method is invoked when a connection to the server is established.

For other callback methods, see the handout and OCSF Javadoc.

Control and Utility Methods

These are methods that you *invoke* to tell the framework to do something or perform a query. They are provided by AbstractClient. Don't override these methods (unless you have a genuine reason to do so, and probably call the superclass method as part of your override).

`sendToServer( Object )`	send a message to server. May throw exception.
`openConnection( )`	attempt to connect to server. May throw exception.
`closeConnection( )`	close the connection.
`isConnected()`	test returns true if currently connected to a server

Problem 2: Write a Chat Server for 1-to-1 Chat

Write your own server using OCSF's AbstractServer class.

You should create a server that requires clients to identify themselves, so you know which user is connected on which ClientConnection object.

2.1 Write a class that extends AbstractServer or ObservableServer (both classes have the same methods).

2.2 When a new client connects, you should wait for the client to (somehow) identify the user. Design your own solution to this. The ClientConnection object has a map that you can use to store arbitrary values. You can use this to store the user's name. For example:

```
client.setInfo("username", clientname );
```

2.3 When a user logs in, servers send a message to all clients telling them "`Clientname connected`" (you can design the format of this message. It doesn't have to be a String.)

2.4 When a logged-in client sends a one-to-one message like this:

```
To:  Anchan
Hi, Anchan. How are you?
```

your server should find a client connection with login name "*Anchan*" and send the message. Be sure to tell Anchan who the message is from!

2.3 If a client sends the String message "`Logout`" then close the client connection and tell all other clients "*Anchan logged off*".

2.4 If the client sends any other message, the server responds that message is not recognized.

How to Record the Client Name

OCSF creates a ClientConnection object for each connected client, and passes this object as a parameter in handleMessageFromClient.

You can save the client name using the setInfo / getInfo methods. For example:

```
// setInfo is a HashMap. You can use can String as a key
client.setInfo( "username", loginname );
```

How to Find a Client By Name

OCSF AbstractServer doesn't provide an easy way to search the current ClientConnection objects, so you can find a client by username.

One solution is to maintain your own list of **`ClientConnection`** in your server class.
Override the *callback* methods:

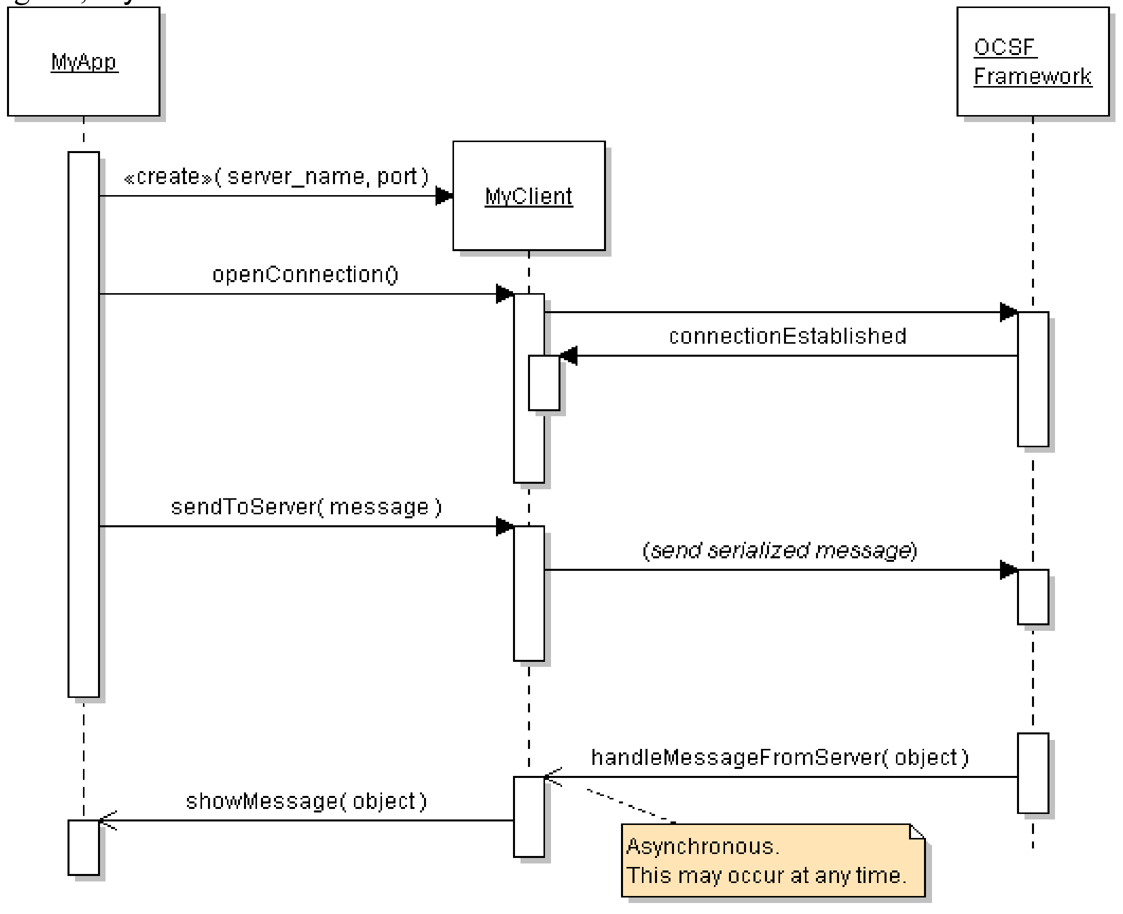
`clientConnected( ClientConnection conn )` - a new client is connected

`clientDisconnected( ClientConnection conn )` - a client has disconnected

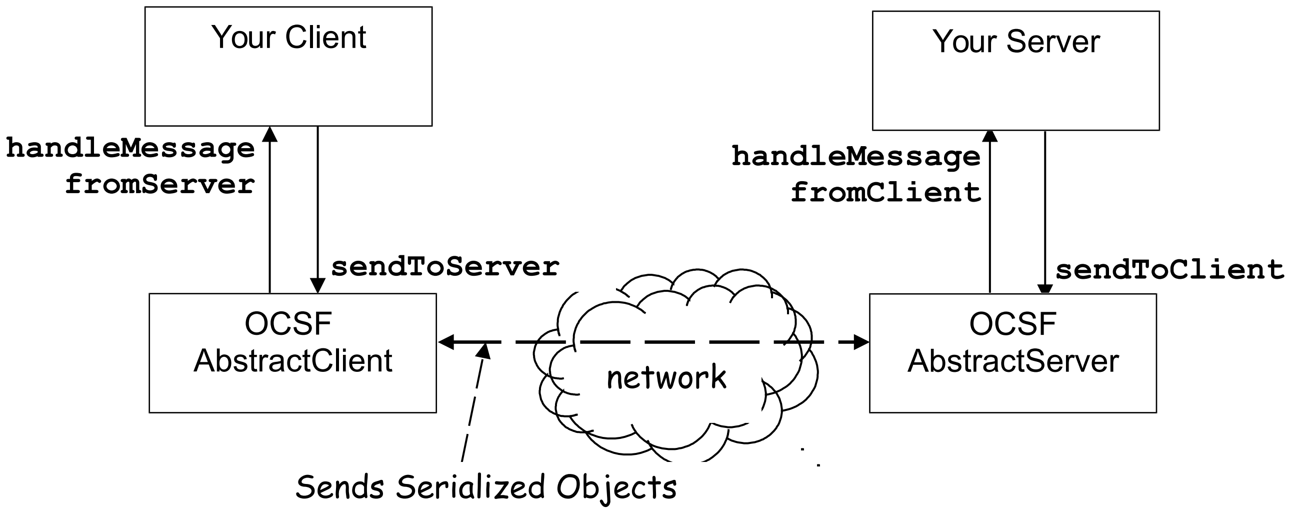
use these hooks to add client connection to your List and remove disconnected clients from your List.

Typical Usage

In this diagram, MyClient is a subclass of AbstractClient.



Conceptual View of OCSF Operation



UML

{abstract} **AbstractClient**	**{abstract}** **AbstractServer**
`<<constructor>>`	`<<constructor>>`
`AbstractClient( host, port )`	`AbstractServer( port: int )`
`+openConnection( )`	`+listen( )`
`+closeConnection( )`	`+close( )`
`+setHost( host : String )   {final}`	`+getNumberOfClients(): int`
`+setPort( port : int )      {final}`	`+getClientConnections(): Thread[ ]`
`+sendToServer( message : Object )`	`+sendToAllClients(msg: Object)`
`{exceptions=IOException}`	`+setBacklog( size : int )`
`+handleMessageFromServer( Object )`	`+setConnectionFactory(`
`{abstract}`	`factory: ConnectionFactory )`

References

Lethbridge and Lagariere, *Object-Oriented Software Engineering,* 2E. Textbook describes use of OCSF and a chat project.

A standard, high-performance framework for chat and other applications is XMPP.

XMPP is a standard protocol for real-time messaging; XMPP was originally called *Jabber*. Google Talk uses XMPP. You can use XMPP to write your own Chat client or other Internet application. There are many several free XMPP servers (such as *Jabberd* and *OpenFire*), clients, and libraries. XMPP can be used for more than just chat.

SMACK is an open-source XMPP library for Java. It is used by several chat applications. http://www.igniterealtime.org/projects/smack/

- How to use SMACK to write a Java client: http://www.javacodegeeks.com/2010/09/xmpp-im-with-smack-for-java.html
- Other two articles in the same series describe infrastructure for using XMPP.

XEP-0045 Multi-User Chat. Protocol for a multi-user chat using XMPP. http://xmpp.org/extensions/xep-0045.html#bizrules-message