

Purpose	Learn to apply a framework in developing an application
Prerequisites	Read the handout "Basing Software on Reusable Technology" from Lethbridge <i>Object-Oriented Software Engineering</i> , 2nd Ed.
Files	Download ocsf-2.31.jar from class repository. The jar file includes source, Javadoc, and binary code. Add this JAR file to your project as "external archive" If you want to read the Javadoc, open the JAR with Winzip or similar and extract the "doc" directory.

Overview

The purpose of this lab is to practice using a framework. We use the OCSF framework to provide network services and management of connections.

Without the framework, we'd need several labs just to implement simple network communication.

You should observe that a framework reduces development time and usually results in higher quality software. Most frameworks are extensively tested both by developers and users, so they typically has fewer bugs and a better architecture than software written from scratch.

In the next lab, you will design a Chat program using OCSF, and implement the first iteration of Chat.

Using OCSF

The OCSF framework is described in the handout by Lethbridge.

Your client uses methods of OCSF's **AbstractClient** or **ObservableClient** classes to connect to a server and send/receive objects.

The first step is to create a subclass of **AbstractClient** or **ObservableClient**.

Callback Methods (Don't Call Us, We'll Call You)

The framework has several *callback methods* that you can *override* in your client (your subclass of **AbstractClient** or **ObservableClient**). The framework itself will invoke these methods to let your application know when something happens.

You should override the callback methods and add the logic for your application. In your client, **handleMessageFromServer** means you received a message, so you should display the message in the client's window. If **connectionClosed** is invoked, your client should inform the user that the client has been disconnected from the server.

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

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

Control and Utility Methods

These are methods that you *invoke* but don't override. They are provided by **AbstractClient**.

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

Problem 1: A Client that sends Strings as Messages

Create a client as a subclass of `AbstractClient` or `ObservableClient`. `ObservableClient` provides the same methods as `AbstractClient` and also extends Java's `Observable`, so its useful to use `ObservableClient` for writing a GUI interface.

Your client should do this:

- Connect to server and display a "connected" message on client UI.
- Send messages from client to server.
- Display messages received from the server.
- Close the connection when you signal that you want to quit.

Example using a console interface (you can write a GUI if you prefer):

```
Connected to server 158.108.32.99    <-- message from your program
> Hello. Please Login                <-- message received from server
Message:  Login Fataijon          <-- your name (bold)
> Hello Fataijon
Message: Get Task 1
> What is 2+2?
Message: 5
> Sorry, wrong answer.
Message: 4
> Correct!
Message: quit
Disconnected.
```

When you complete this task, your name will be added to the scoreboard.

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

Write your own Chat server using OCSF's `AbstractServer` class.

You should create a server that requires clients to send a login message, and then send messages to each other. Instead of broadcasting messages to everyone, only send the message to designated receiver. Your application must recognize 4 kinds of messages, which are all Strings.

Login Message	One-to-One Message	Logout Message	Server message
Login <i>username</i>	To: <i>receivername</i> message text	Logout	server can send any text message (string)

Since one-to-one messages require 2 lines, you will need to write a client, too.

2.1 When a new client connects, you should wait for the client to send "Login *clientname*". When he sends this, add *clientname* to the `ClientConnection` object. For example:

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

2.2 When a user logs in, servers send a message to all clients telling them "*Clientname* connected"

2.3 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! If Anchan is not logged in, tell the sender that recipient is not logged in. If Anchan is logged in more than once, forward the message to *all* clients named "Anchan".

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 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:

```
handleMessageFromClient(Object msg, ClientConnection connection)
{
    //todo determine the client's name from message (on login only)
    String loginname = ?
    // setInfo uses a Map. You can use can String as a key
    connection.setInfo( "username", loginname );
    // to get the client's name from ClientConnection use:
    String username = (String) connection.getInfo( "username" );
}
```

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 own 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. You could also use a Map, but must design the case where same user is logged in more than one time.

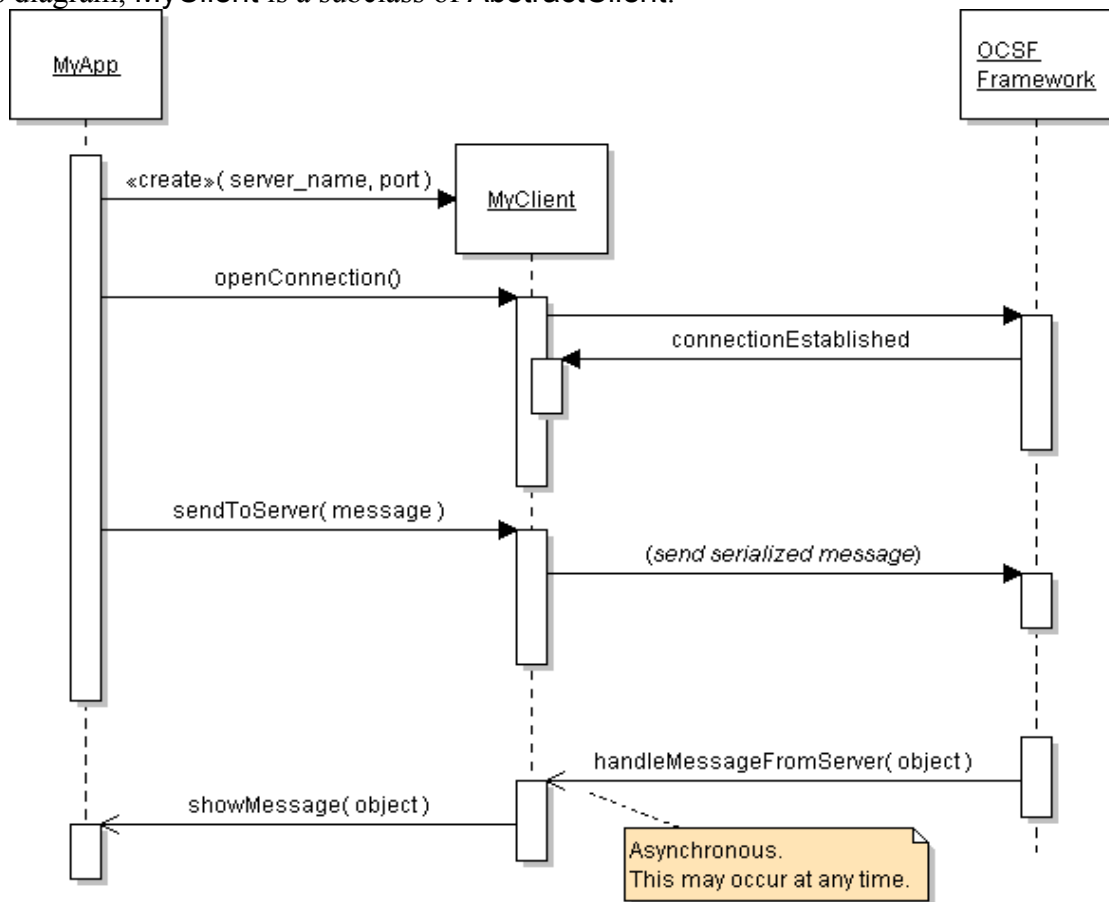
Better Protocol

The above examples use Strings for messages. OCSF lets us send any kind of `Serializable` objects, so we can create a better protocol by sending objects. If you want to write a Chat server, a better design would be to define a hierarchy of `Message` objects and send serialized Messages instead of Strings.

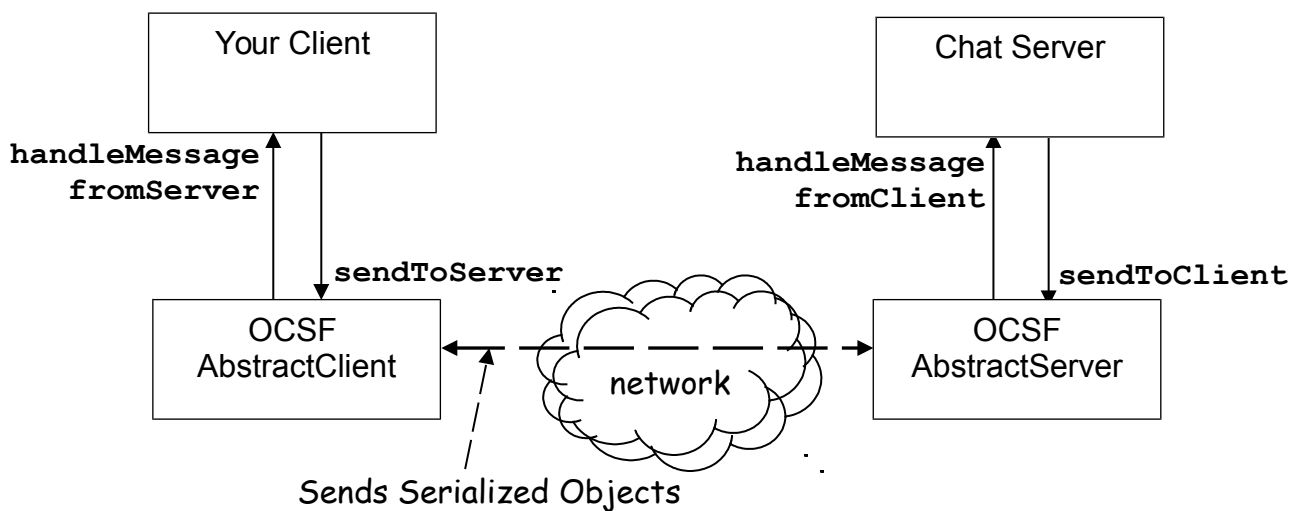
```
class Message implements Serializable {
    // define your base Message attributes and methods
}
```

Typical Usage

In this diagram, MyClient is a subclass of AbstractClient.



Conceptual View of OCSF Operation



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>