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LAB REPORT

LAB NO : 2

SUBJECT: Distributed System

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SUBMITTED TO: DEPARTMENT OF COMPUTER ENGINEERING
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TITLE: Remote Method Invocation in JAVA

1.Objective:

The objective of this lab is to learn about RMI and implement a simple client side and server-side system using java.

2.Software Used:

The Java Development Kit (JDK) was used as a compiler, notepad was used to write the code and the windows command prompt was used to execute the code.

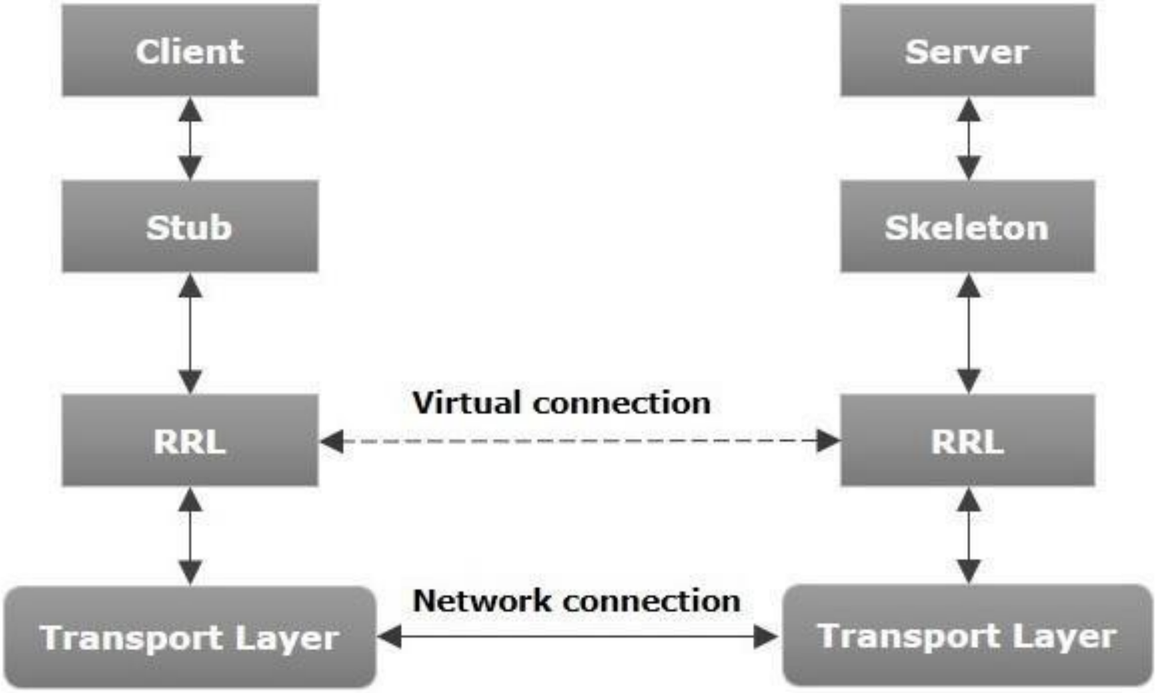
3.Introduction

RMI stands for Remote Method Invocation. It is a mechanism that allows an object residing in one system (JVM) to access/invoke an object running on another JVM. RMI is used to build distributed applications; it provides remote communication between Java programs. It is provided in the package java.rmi.

In an RMI application, we write two programs, a server program (resides on the server) and a client program (resides on the client).

- Inside the server program, a remote object is created and reference of that object is made available for the client (using the registry).
- The client program requests the remote objects on the server and tries to invoke its methods.

The following diagram shows the architecture of an RMI application.



- Transport Layer − This layer connects the client and the server. It manages the existing connection and also sets up new connections.
- Stub − A stub is a representation (proxy) of the remote object at client. It resides in the client system; it acts as a gateway for the client program.
- Skeleton − This is the object which resides on the server side. stub communicates with this skeleton to pass request to the remote object.
- RRL(Remote Reference Layer) − It is the layer which manages the references made by the client to the remote object.

4.Code Implementation

Client side code :

```
import java.rmi.Naming;
public class RmiClient
{ public static void main(String args[]) throws Exception {
        RmiServerIntf obj =
        (RmiServerIntf)Naming.lookup("//localhost/RmiServer");
        //returns a reference, a stub, for the remote object
    associated with the   specified name, i.e, RmiServer in //this case.
        System.out.println(obj.getMessage());
    }
}
```

Server side code :

```
import java.rmi.Naming; import
java.rmi.RemoteException; import
java.rmi.registry.LocateRegistry; import
java.rmi.server.UnicastRemoteObject;

public class RmiServer extends UnicastRemoteObject implements
RmiServerIntf { public static final String MESSAGE = "Hello
World";

public RmiServer() throws RemoteException { super(0); //
    required to avoid the 'rmic' step, see below
}

public String getMessage() {
    return MESSAGE;
}

public static void main(String args[]) throws Exception
    { System.out.println("RMI server started"); try {
            //special exception handler for registry creation
            LocateRegistry.createRegistry(1099);
            System.out.println("java RMI registry created.");
        }
        catch (RemoteException e) {
            // do nothing, error means registry already exists
            System.out.println("java RMI registry already exists.");
```

```
                        }

                        //Instantiate RmiServer
                        RmiServer obj = new RmiServer();
                        // Bind this object instance to the name "RmiServer"
                        Naming.rebind("//localhost/RmiServer", obj);
                        System.out.println("PeerServer bound in registry");
        }
}
```

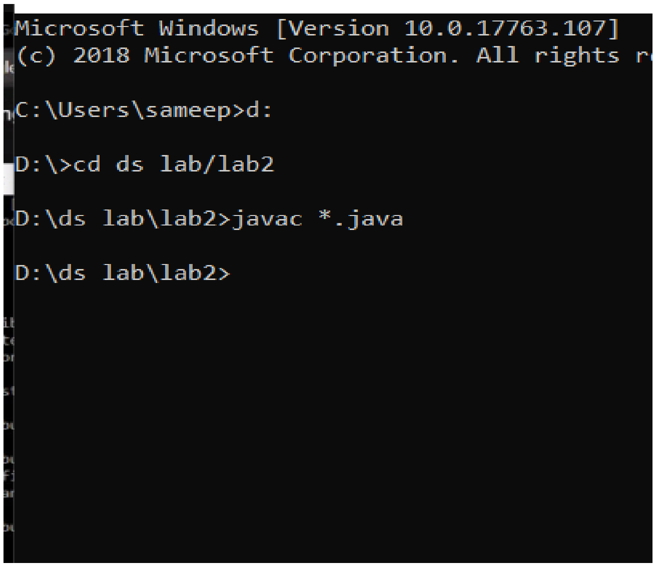
Server Interface side code :

```
import java.rmi.Remote;

import java.rmi.RemoteException;

public interface RmiServerIntf extends Remote { public
        String getMessage() throws RemoteException;
}
```

5.Result

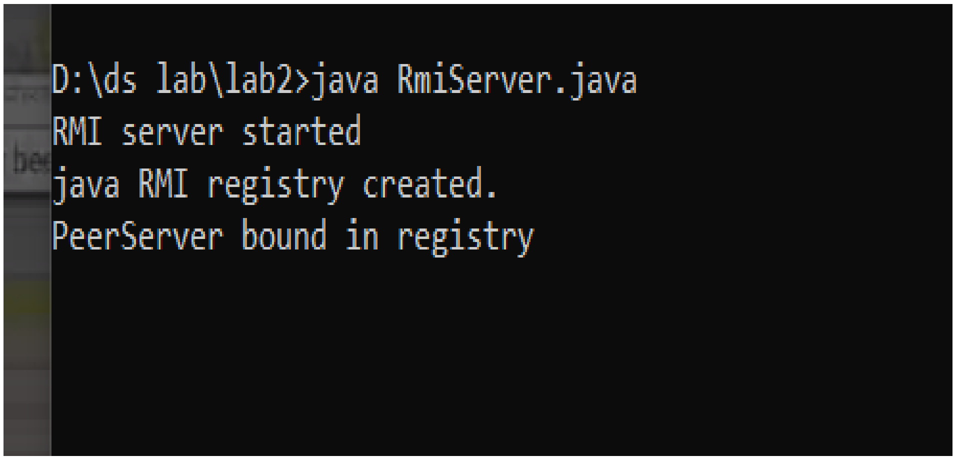
The following results were observed when the code was executed.

First the rmi server and client code,interfae code was complied.



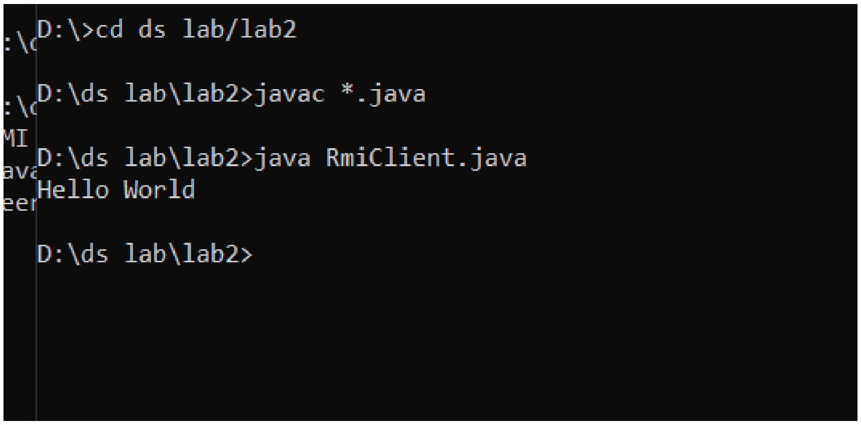
```
Microsoft Windows [Version 10.0.17763.107]
(c) 2018 Microsoft Corporation. All rights r

C:\Users\sameep>d:

D:\>cd ds lab/lab2

D:\ds lab\lab2>javac *.java

D:\ds lab\lab2>
```

Server code was executed



```
D:\ds lab\lab2>java RmiServer.java
RMI server started
java RMI registry created.
PeerServer bound in registry
```

Client code was executed



```
D:\>cd ds lab/lab2

D:\ds lab\lab2>javac *.java

D:\ds lab\lab2>java RmiClient.java
Hello World

D:\ds lab\lab2>
```

Operation on the client was observed as Hello World.

6.Discussion

We implemented a simple RMI using java and observed the following limitations:

- It is hard to tell which objects are local and which are remote.
- Less efficient than socket objects.
- Assuming the default threading will allow ignoring the coding, being the servers are thread- safe and robust.
- It cannot use the code out of the scope of java.
- Security issues need to be monitored more closely.

7.Conclusion

RMI provides a solid platform for truly object-oriented distributed computing. Hence, in this lab we have used RMI to implement a simple client side and server-side system using java.