How to run Java RMI Application

Difficulty Level : Easy Last Updated : 02 Nov, 2018

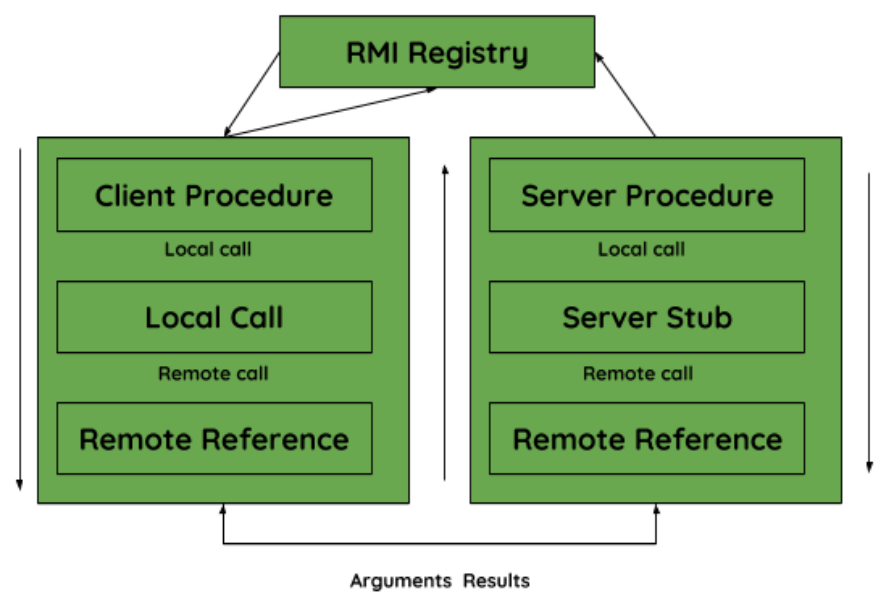
Prerequisite: RMI

RMI (Remote Method Invocation) is used for distributed object references system. A distributed object is an object which publishes its interface on other machines. A Remote Object is a distributed object whose state is encapsulated. Stub and Skeleton are two objects used to communicate with the remote object.

Stub: Stub is a gateway for client program which is used to communicate with skeleton object, by establishing a connection between them.

Skeleton: Resides on Server program which is used for passing the request from stub to the remote interface.

How communication and process takes place in RMI:



Steps to Run Java RMI Application in Console

1. **Creation of classes and interfaces for the problem statement**: The steps involved in this are as follows:
   - **Create a Remote Interface which extends java.rmi.Remote**:
     A remote interface determines the object that can be invoked remotely by the client. This interface can be communicated with the client's program. This Interface must extend **java.rmi.Remote** Interface.

Problem Statement: Create an RMI Application for finding the factorial of a number

Interface Program

```
import java.math.BigInteger;

// Creating an Interface
public interface Factorial
    extends java.rmi.Remote {

    // Declaring the method
    public BigInteger fact(int num)
        throws java.rmi.RemoteException;
}
```

- **Create a class which extends java.rmi.server.UnicastRemoteObject and implements the previous interface.**
  This class will implement the remote interface. Do the required calculation for the problem statement.

Implementation of Interface

```
import java.math.BigInteger;

// Extends and Implement the class
// and interface respectively
public class FactorialImpl
    extends java.rmi.server.UnicastRemoteObject
    implements Factorial {

    // Constructor Declaration
    public FactorialImpl()
        throws java.rmi.RemoteException
    {
        super();
    }
```

```
    // Calculation for the problem statement
    // Implementing the method fact()
    // to find factorial of a number
    public BigInteger fact(int num)
        throws java.rmi.RemoteException
    {
        BigInteger factorial = BigInteger.ONE;

        for (int i = 1; i <= num; ++i) {
            factorial = factorial
                            .multiply(
                                BigInteger
                                    .valueOf(i));
        }
        return factorial;
    }
}
```

- **Create a Server Class (with localhost and service name)**
  For hosting a service, the server program is created whereby using java.rmi.Naming.rebind() method can be called which takes two arguments i.e., an object reference (service name) and instances reference.

Server Program

```
import java.rmi.Naming;

public class FactorialServer {

    // Implement the constructor of the class
    public FactorialServer()
    {
        try {
            // Create a object reference for the interface
            Factorial c = new FactorialImpl();

            // Bind the localhost with the service
            Naming.rebind("rmi:// localhost/FactorialService", c);
        }
        catch (Exception e) {
            // If any error occur
            System.out.println("ERR: " + e);
        }
```

```
    }

    public static void main(String[] args)
    {
        // Create an object
        new FactorialServer();
    }
}
```

- **Create a Client Class (with localhost and service name)**
  Client program will invokes java.rmi.Naming.lookup() method for RMI URL and returns an instance of object type (Factorial Interface). All RMI is done on this object

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Client Program

```
import java.net.MalformedURLException;
import java.rmi.Naming;
import java.rmi.NotBoundException;
import java.rmi.RemoteException;

public class FactorialClient {
    public static void main(String[] args)
    {

        try {
            // Create an remote object with the same name
            // Cast the lookup result to the interface
            Factorial c = (Factorial);
            Naming.lookup("rmi:// localhost/FactorialService");

            // Call the method for the results
            System.out.println(c.fact(30));
        }

        // If any error occur
        catch (MalformedURLException murle) {
            System.out.println("\nMalformedURLException: "
                               + murle);
        }

        catch (RemoteException re) {
            System.out.println("\nRemoteException: "
                               + re);
```

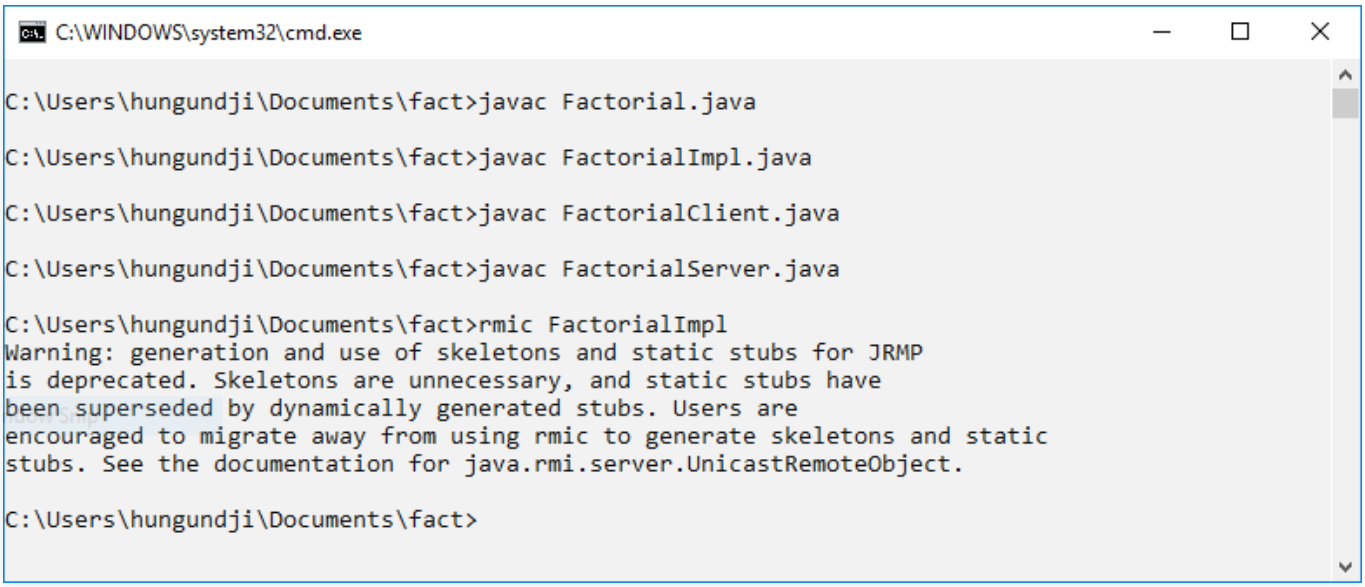
```
            }

            catch (NotBoundException nbe) {
                System.out.println("\nNotBoundException: "
                                   + nbe);
            }

            catch (java.lang.ArithmeticException ae) {
                System.out.println("\nArithmeticException: " + ae);
            }
        }
    }
```

2. **Compilation of all program**

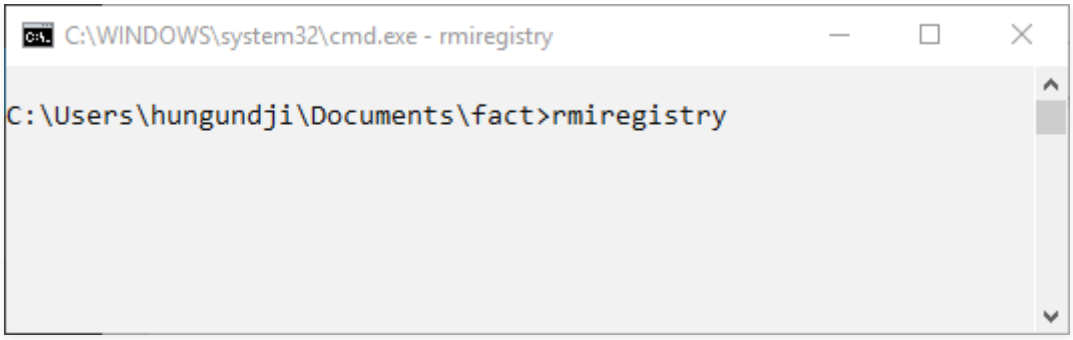
   Use javac to compile all four programs and rmic (RMI Compiler) to create a stub and skeleton class files.



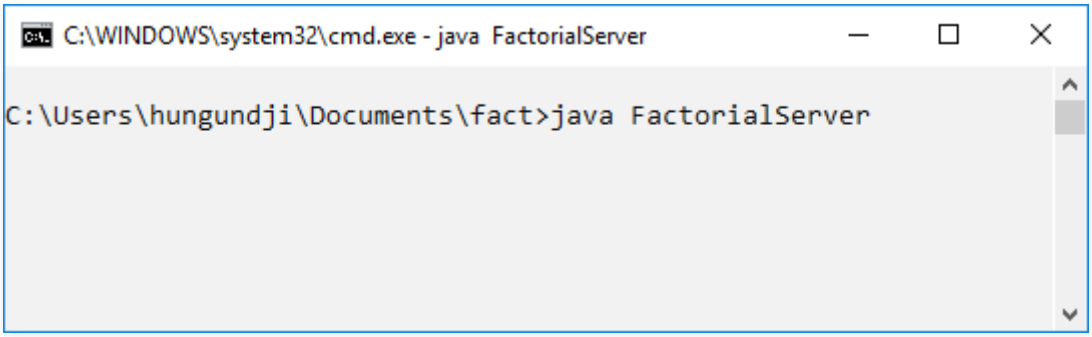
3. **Running the system:**

   After the compilation phase, the system is now ready to run. To run the system, open three console screen (move to that path where the program resides). One for the client, one for server and one for the RMI Registry.

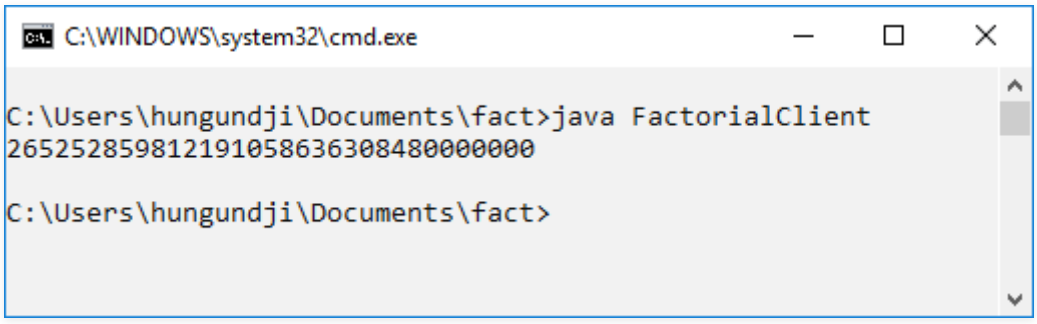
   - Start with a registry, use **`rmiregistry`**, if there is no error registry will start running and now move to second screen.



- In the second console run the server program and host the FactorialService. It will start and wait for the client connection and it will load the implementation into memory.



- In the third console, run the client program.



In this way RMI can be run in three console for localhost. RMI uses Network stack and TCP/IP Stack for communication of three different JVM's.

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