```
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```

TITLE : Design a distributed application using RMI.

AIM : To implement a basic calculator (operations : +, - , /, *)using RMI.

OBJECTIVE : To implement RMI for implementing basic mathematical operations.

To have a client and server execute the RMI.

THEORY:

RMI (Remote Method Invocation):

RMI, or Remote Method Invocation, is a Java-based technology that enables the execution of methods on objects residing in a different Java Virtual Machine (JVM) across a network. It simplifies the development of distributed applications in Java by allowing objects in one JVM to invoke methods on objects in another JVM.

Components of RMI:

1. **Remote Interface:**
   - Defines methods that can be invoked remotely.
   - Methods must throw `RemoteException` to indicate they can be called remotely.
2. **Remote Object:**
   - Implements the remote interface.
   - Extends `UnicastRemoteObject` or uses `exportObject` for remote accessibility.
   - Handles the actual implementation of remote methods.
3. **Registry:**
   - Acts as a lookup service for remote objects.

- Server registers its remote object with the registry.
- Clients look up remote objects using the registry.

Two Types of Remote Classes in RMI:

1. **Extending UnicastRemoteObject:**
   - Remote class extends `UnicastRemoteObject`.
   - Convenient for making a class remotely accessible.
2. **Using exportObject Method:**
   - Remote class implements the remote interface.
   - Uses `UnicastRemoteObject.exportObject` method for remote accessibility.

PSEUDO CODE/STEPS OF ALGORITHM :

```
RemoteInterface:

import java.rmi.Remote;
import java.rmi.RemoteException;

public interface MyRemoteInterface extends Remote {
    int add(int a, int b) throws RemoteException;
    int subtract(int a, int b) throws RemoteException;
    int multiply(int a, int b) throws RemoteException;
    double divide(int a, int b) throws RemoteException;
}
MyServer:
import java.rmi.RemoteException;
import java.rmi.server.UnicastRemoteObject;

public class MyServer extends UnicastRemoteObject implements
MyRemoteInterface {
    public MyServer() throws RemoteException {
        // Constructor to declare that it throws
RemoteException
    }
```

```
    public int add(int a, int b) throws RemoteException {
        return a + b;
    }

    public int subtract(int a, int b) throws RemoteException {
        return a - b;
    }

    public int multiply(int a, int b) throws RemoteException {
        return a * b;
    }

    public double divide(int a, int b) throws RemoteException {
        if (b == 0) {
            throw new RemoteException("Division by zero is not
allowed.");
        }
        return (double) a / b;
    }

    public static void main(String[] args) {
        try {
            MyServer server = new MyServer();
            java.rmi.Naming.rebind("MyServer", server);
            System.out.println("Calculator Server is
running...");
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
}
```

MyClient:

```
import java.rmi.Naming;

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

```
        try {
            MyRemoteInterface remoteObject =
(MyRemoteInterface) Naming.lookup("rmi://localhost/MyServer");
            /* reading file for reading value of a and b */
            java.io.File file = new java.io.File("input.txt");
            java.util.Scanner input = new
java.util.Scanner(file);
            int a = input.nextInt();
            int b = input.nextInt();
            input.close();
            System.out.println("Server says: " + a + " + " + b
+ " = " + remoteObject.add(a, b));
            System.out.println("Server says: " + a + " - " + b
+ " = " + remoteObject.subtract(a, b));
            System.out.println("Server says: " + a + " * " + b
+ " = " + remoteObject.multiply(a, b));
            System.out.println("Server says: " + a + " / " + b
+ " = " + remoteObject.divide(a, b));
        } catch (Exception e) {
            e.printStackTrace();
        }
    }
}
```

PLATFORM : Linux

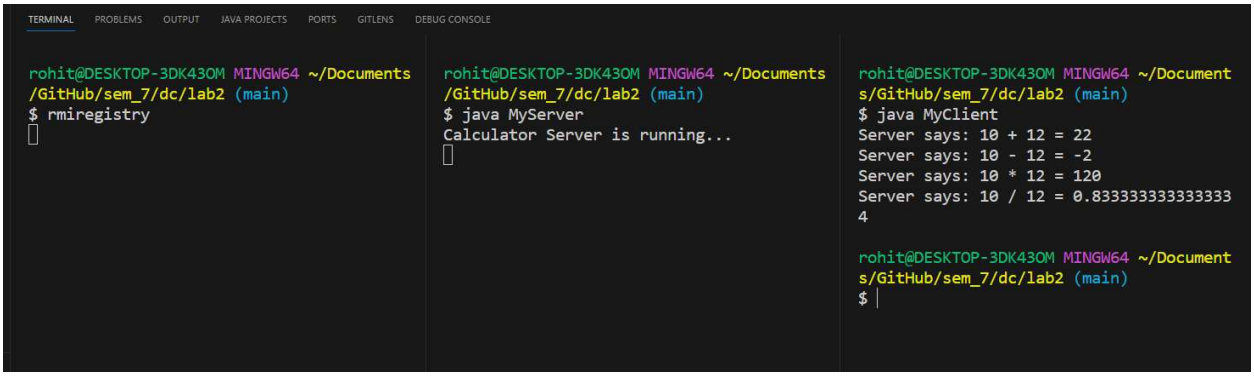
PROGRAMMING LANGUAGE: C,compiler :gcc/cc

PLATFORM: Linux

LANGUAGE: C

INPUT: The values for mathematical operations

OUTPUT: The output based on +, - ,/ ,* operations



CONCLUSION : Thus, RMI has been studied and implemented on Linux platform.

FAQs : 1. Differentiate between RPC and RMI

2. what does rmic do ?

3.what is the importance of RMI registry

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FAQ:

Q1. Differentiate between RPC and RMI?

Ans.

	RPC	RMI
② Communication style	① Remote Procedure Call: allows a program to execute procedure on a remote address space	① Remote Method Invocation ② Specifically designed for objects in Java to invoke methods on remote objects.
③ Language Neutrality:	Can be language-neutral; client and server can be implemented in different languages.	③ Java-centric; designed for Java objects; limiting language independence.
④ object marshalling:	Standard data types are marshalled and unmarshalled for parameter passing	④. Support object serialization allowing complex objects to be passed seamlessly.
⑤ Platform dependency:	Can be platform-dependent based on the specific RPC implementation.	⑤. RMI Platform-independent, running on any system with a compatible Java Virtual Machine (JVM).

Q2. What does rmic do?

Ans- 'rmic' stands for "Remote Method Invocation Compiler". It is a tool provided by Java to generate stub and skeleton classes for RMI objects. When developing distributed application using RMI, you define remote interface for the objects that needs to be accessed remotely. 'rmic' take these interfaces and generates the necessary classes that facilitate communication between the client and the server.

Q3. What is the importance of RMI registry.

Ans. 1. Object Registration: Allows remote objects to be registered with a name, making the accessible to clients.

2. Location Transparency: Clients can access remote object through the RMI Registry without needing to know their physical location.