## Remote Method Invocation in Java

Presenters:
Anil Adhikari
Nabin Bhandari
Shreedhar Acharya

## Introduction

- a Java API that performs remote method invocation, the object-oriented equivalent of remote procedure calls (RPC).
- Supports direct transfer of serialized Java classes and distributed garbage collection.
- an alternative to low level sockets.
- Instead of creating objects on local machines we create some of the objects on other machines and we communicate with those objects as we would normally do with local objects.

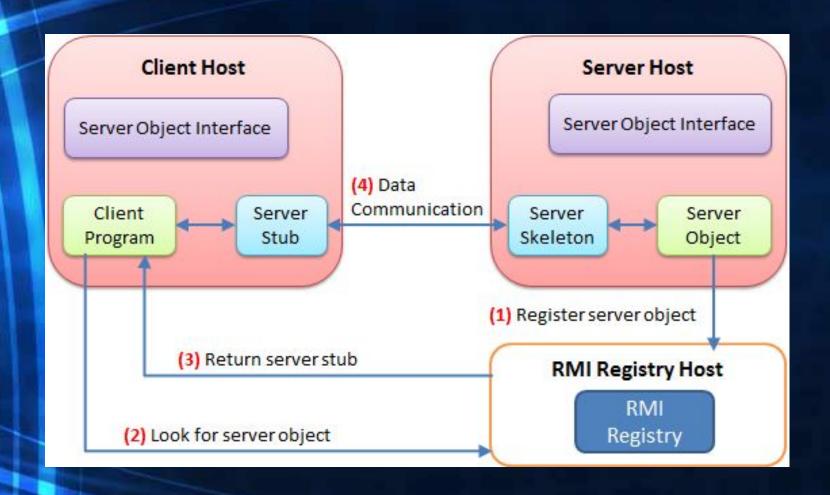
#### WHAT IS RMI?

- RMI is a core package of the JDK 1.1 and above that can be used to develop distributed application.
- It enables software developers to write distributed applications in which the methods of remote objects can be invoked from other JVMs

## Goals of RMI

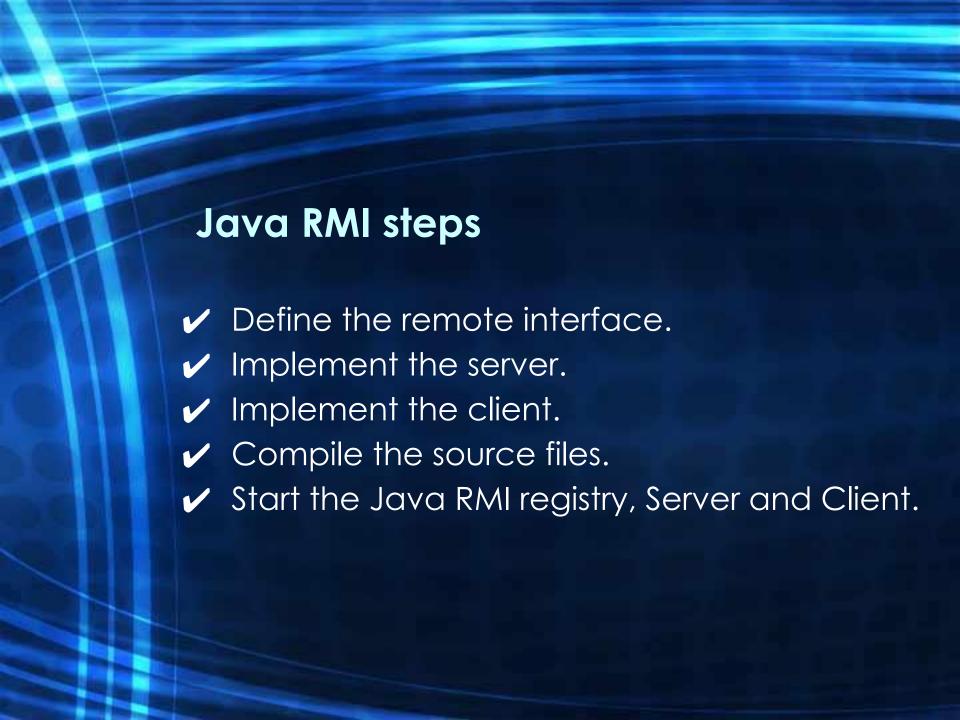
- Support seamless remote invocations on objects in different java virtual machines.
- Integrate the distributed object model into the Java language in a natural way while retaining most of the Java language's object semantics.
- Make writing reliable distributed applications as simple as possible.
- Preserve the safety provided by the java sun real time environment.

## Java RMI Overview



# Security

- There are a number of security issues that you should be aware of when developing mission-critical systems in RMI.
- There is no authentication; a client just requests and object (stub), and the server supplies it. Subsequent communication is assumed to b from the same client.
- There is no access control to the objects
- There are no security checks on the RMI registry itself; any caller Is allowed to make request.
- There is no version control between the stubs and the skeletons, making it possible for client to use a down-level stub to access a more recent skeleton breaking release-to-release binary compatibility



## **Example**

- This example will follow to create a distributed version of the classic Hello World program using Java Remote Method Invocation (Java RMI).
- uses a simple client to make a remote method invocation to a server which may be running on a remote host.
- The files which shall be created are:
  - Hello.java a remote interface.
  - Server.java a remote object implementation that implements the remote interface
  - Client.java a simple client that invokes a method of the remote interface.

```
1  //Hello.java
2  package example.hello;
3
4  import java.rmi.Remote;
5  import java.rmi.RemoteException;
6
7  public interface Hello extends Remote {
8  String sayHello() throws RemoteException;
9 }
```

```
//Server.java
                                                      Server.java
    package example.hello;
    import java.rmi.registry.Registry;
    import java.rmi.registry.LocateRegistry;
    import java.rmi.server.UnicastRemoteObject;
 5
 6
    public class Server implements Hello {
        public String sayHello() { return "Hello, world!"; }
8 0
        public static void main(String args[]) {
11
12
            try {
13
                Server obj = new Server();
14
                Hello stub = (Hello) UnicastRemoteObject.exportObject(obj, 0);
15
                Registry registry = LocateRegistry.createRegistry(1099);
16
17
                registry.bind("Hello", stub);
18
                System.out.println("Server ready");
19
20
             catch (Exception e) {
                System.err.println("Server exception: " + e.toString());
21
22
                e.printStackTrace();
23
24
25
```

```
//Client.java
                                                      Client.java
    package example.hello;
    import java.rmi.registry.LocateRegistry;
    import java.rmi.registry.Registry;
 5
 6
    public class Client {
        public static void main(String[] args) {
8
            String host = (args.length < 1) ? null : args[0];
10
            try {
                Registry registry = LocateRegistry.getRegistry(host);
11
12
                Hello stub = (Hello) registry.lookup("Hello");
13
                String response = stub.sayHello();
                System.out.println("response: " + response);
14
             } catch (Exception e) {
15
                System.err.println("Client exception: " + e.toString());
16
                e.printStackTrace();
17
18
19
20
21
```

#### References

- Qusay H. Mahmoud, (1999). Distributed Programming with Java. Greenwich CT: Manning Publications Co.
- https://en.wikipedia.org/wiki/Java remote method invocation
- https://docs.oracle.com/javase/8/docs/technotes/guides/ rmi/hello/hello-world.html
- http://lycog.com/wp-content/uploads/2011/03/java-rmi-o verview.png

