

day03 Dubbo

Apache Dubbo 是一款高性能、轻量级的开源Java RPC框架，提供面向接口代理的高性能RPC调用、智能负载均衡、服务自动注册和发现、运行期流量调度、可视化服务治理和运维等功能。

官网：

<http://dubbo.apache.org/>

1、RPC核心

RPC (Remote Procedure Call) — 远程过程调用，它是一种通过 网络 从远程计算机程序上请求服务，而不需要了解底层网络技术的协议，在面向对象的编程语言中，远程过程调用即是 远程方法调用

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RPC调用过程

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java中RPC框架比较多，常见的有RMI、Hessian、Thrift、gRPC、bRPC、motan、Dubbo等，其实对于RPC框架而言，核心模块就是通讯和序列化

接下来我们就分别看一下常见的RPC框架

- RMI

1) RMI(remote method invocation)是java原生支持的远程调用，RMI采用JRMP (Java Remote Messaging Protocol) 作为通信协议，可以认为是纯java版本的分布式远程调用解决方案。

2) RMI的核心概念

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3) RMI步骤

1. 创建远程接口，并且继承**java.rmi.Remote**接口
2. 实现远程接口，并且继承：**UnicastRemoteObject**
3. 创建服务器程序：**createRegistry()**方法注册远程对象
4. 创建客户端程序 (获取注册信息，调用接口方法)

常见实体类（注意实体类Serializable）

```
@Data
@NoArgsConstructor
@AllArgsConstructor
public class User implements Serializable {

    private String name;
    private int age;
    private String sex;

}
```



```
public interface UserService extends Remote {  
  
    String sayHello(String name) throws RemoteException;  
  
}
```

提供接口的实现类

```
public class UserServiceImpl extends UnicastRemoteObject implements UserService  
{  
  
    public UserServiceImpl() throws RemoteException{}  
  
    @Override  
    public String sayHello(String name) throws RemoteException{  
        return "hello"+name;  
    }  
}
```

将本地服务暴露出去，供外部调用

```
try {  
    UserService userService = new UserServiceImpl();  
    LocateRegistry.createRegistry(8888);  
    //暴露服务  
    Naming.bind("rmi://localhost:8888/UserService", userService);  
    System.out.println("提供userService服务。。。。");  
} catch (RemoteException e) {  
    e.printStackTrace();  
} catch (AlreadyBoundException e) {  
    e.printStackTrace();  
} catch (MalformedURLException e) {  
    e.printStackTrace();  
}
```

客户端远程调用服务，客户端需要依赖服务接口

```
userService = (UserService) Naming.lookup("rmi://localhost:8888/UserService");  
//userService代理对象  
System.out.println(userService);  
  
System.out.println(userService.sayHello("传智小月"));
```

- Hessian

Hessian使用C/S方式，基于HTTP协议传输，使用Hessian二进制序列化。

server端：

添加hessian的maven依赖



```
<groupId>com.caucho</groupId>  
<artifactId>hessian</artifactId>  
<version>4.0.7</version>  
</dependency>
```

创建接口UserService

```
public interface UserService {  
  
    String sayHello(String name);  
  
}
```

实现类

```
public class UserServiceImpl implements UserService {  
  
    @Override  
    public String sayHello(String name){  
        return "hello"+name;  
    }  
}
```

web.xml中配置HessianServlet

```
<servlet>  
    <servlet-name>HessianServlet</servlet-name>  
    <servlet-class>com.caucho.hessian.server.HessianServlet</servlet-class>  
    <init-param>  
        <param-name>service-class</param-name>  
        <param-value>com.itheima.demo.impl.UserServiceImpl</param-value>  
    </init-param>  
</servlet>  
<servlet-mapping>  
    <servlet-name>HessianServlet</servlet-name>  
    <url-pattern>/api/service</url-pattern>  
</servlet-mapping>
```

添加tomcat7插件启动服务

```
<build>  
    <plugins>  
        <plugin>  
            <groupId>org.apache.tomcat.maven</groupId>  
            <artifactId>tomcat7-maven-plugin</artifactId>  
            <version>2.2</version>  
            <configuration>  
                <port>8888</port>  
                <path>/</path>  
                <uriEncoding>UTF-8</uriEncoding>  
            </configuration>  
        </plugin>  
    </plugins>
```

客户端：

添加hessian的maven依赖

```
<dependency>
  <groupId>com.caucho</groupId>
  <artifactId>hessian</artifactId>
  <version>4.0.7</version>
</dependency>
```

创建跟server端相同的接口UserService(同上)

创建测试类测试

```
public class ClientTest {

    public static void main(String[] args) throws MalformedURLException {
        String url = "http://localhost:8888/api/service";

        HessianProxyFactory factory = new HessianProxyFactory();
        UserService api = (UserService) factory.create(UserService.class, url);
        System.out.println(api.sayHello("黑马程序员"));
    }
}
```

运行结果如下：

```
"C:\Program Files\Java\jdk1.8.0_161\bin\java.exe" ...
hello黑马程序员
```

- Thrift: FaceBook开源RPC框架，典型的CS架构，支持跨语言，客户端和服务端可以使用不同的语言开发，thrift通过IDL(Interface Description Language)来关联客户端和服务端。
- gRPC google
- dubbo

2、手写RPC框架

基本实现思路：



- registry注册
- protocol协议

服务提供者：

1、定义服务接口和实现类

接口HelloService

```
public interface HelloService {  
  
    void sayHello(String message);  
  
}
```

实现类HelloServiceImpl

```
public class HelloServiceImpl implements HelloService {  
  
    @Override  
    public void sayHello(String message) {  
        System.out.println(message);  
    }  
  
}
```

2、服务注册

此处注册中心我们将服务注册在map集合中，结构:Map<String,Map<URL,Class>> 外边map的key存储服务接口的全类名,URL封装了调用服务的ip和port,里边value指定指定具体实现类的全类名

注册中心类提供注册服务并暴露服务和发现服务功能：

```
private static Map<String,Map<URL,Class>> REGISTER = new HashMap<String,  
Map<URL, Class>>();  
  
/**  
 * 注册服务（暴露接口）  
 * @param url  
 * @param interfaceName  
 * @param implClass  
 */  
public static void regist(URL url,String interfaceName,Class implClass){  
    Map<URL,Class> map = new HashMap<URL, Class>();  
    map.put(url,implClass);  
    REGISTER.put(interfaceName,map);  
}  
  
/**  
 * 从注册中心获取实现类（发现服务）  
 * @param url  
 * @param interfaceName  
 * @return  
 */  
public static Class get(URL url,String interfaceName){  
    return REGISTER.get(interfaceName).get(url);  
}
```

URL类定义:

```
@Data
@NoArgsConstructor
@AllArgsConstructor
public class URL {
    private String hostname;
    private Integer port;
}
```

启动服务提供类注册服务并暴露服务

```
public class ServiceProvider {
    public static void main(String[] args) {
        // 注册服务
        URL url = new URL("localhost",8080);
        Register.regist(url, HelloService.class.getName(),
        HelloServiceImpl.class);

        // 启动tomcat暴露服务
        HttpServer httpServer = new HttpServer();
        httpServer.start(url.getHostname(),url.getPort());
    }
}
```

3、protocol协议

服务之间调用的通信协议采用http协议，所以在服务provider中启动tomcat暴露服务

添加内嵌tomcat的依赖

```
<!--内嵌tomcat-->
<dependency>
    <groupId>org.apache.tomcat.embed</groupId>
    <artifactId>tomcat-embed-core</artifactId>
    <version>9.0.12</version>
</dependency>
```

创建HttpServer

```
public class HttpServer {

    /**
     * tomcat服务启动
     * 参考tomcat配置
     * <Server port="8005" shutdown="SHUTDOWN">
     *   <Service name="Catalina">
     *     <Connector port="8080" protocol="HTTP/1.1"
     *       connectionTimeout="20000"
     *       redirectPort="8443"
     *       URIEncoding="UTF-8"/>
     *     <Engine name="Catalina" defaultHost="localhost">
     *       <Host name="localhost" appBase="webapps"
     *         autoDeploy="true"
     *         deploy="true"
     *         xmlValidation="true"
     *         xmlSchemaValidation="true"
     *         deployOnStartup="true"
     *         deployXml="true"/>
     *     </Engine>
     *   </Service>
     * </Server>
     */
}
```



```
*          </Host>
*      </Engine>
*  </Service>
* </Server>
*/
```

```
public void start(String hostname,Integer port){
```

```
    // 实例一个tomcat
```

```
    Tomcat tomcat = new Tomcat();
```

```
    // 构建server
```

```
    Server server = tomcat.getServer();
```

```
    // 获取service
```

```
    Service service = server.findService("Tomcat");
```

```
    // 构建Connector
```

```
    Connector connector = new Connector();
```

```
    connector.setPort(port);
```

```
    connector.setURIEncoding("UTF-8");
```

```
    // 构建Engine
```

```
    Engine engine = new StandardEngine();
```

```
    engine.setDefaultHost(hostname);
```

```
    // 构建Host
```

```
    Host host = new StandardHost();
```

```
    host.setName(hostname);
```

```
    // 构建Context
```

```
    String contextPath = "";
```

```
    Context context = new StandardContext();
```

```
    context.setPath(contextPath);
```

```
    context.addLifecycleListener(new Tomcat.FixContextListener());// 生命周期
```

监听器

```
    // 然后按照server.xml，一层层把子节点添加到父节点
```

```
    host.addChild(context);
```

```
    engine.addChild(host);
```

```
    service.setContainer(engine);
```

```
    service.addConnector(connector);
```

```
    // service在getServer时就被添加到server节点了
```

```
    // tomcat是一个servlet,设置路径与映射
```

```
    tomcat.addServlet(contextPath,"dispatcher",new DispatcherServlet());
```

```
    context.addServletMappingDecoded("/*","dispatcher");
```

```
    try {
```

```
        tomcat.start();// 启动tomcat
```

```
        tomcat.getServer().await();// 接受请求
```

```
    }catch (LifecycleException e){
```

```
        e.printStackTrace();
```

```
    }
```

```
}
```

```
}
```



```
public class HttpServerHandler {

    public void handler(HttpServletRequest req, HttpServletResponse resp){
        try{
            // Http请求流转为对象
            InputStream is = req.getInputStream();
            ObjectInputStream ois = new ObjectInputStream(is);
            Invocation invocation = (Invocation)ois.readObject();

            // 寻找注册中心的实现类，通过反射执行方法
            Class implClass = NativeRegister.get(new
            URL("localhost",8080),invocation.getInterfaceName());
            Method method =
            implClass.getMethod(invocation.getMethodName(),invocation.getParamTypes());
            String result = (String)
            method.invoke(implClass.newInstance(),invocation.getParams());

            // 将结果返回
            IOUtils.write(result,resp.getOutputStream());
        }catch (Exception e){
            e.printStackTrace();
        }
    }
}
```

封装调用参数Invocation

```
@Data
@AllArgsConstructor
@NoArgsConstructor
public class Invocation implements Serializable {

    private String interfaceName;
    private String methodName;
    private Object[] params;
    private Class[] paramTypes;

}
```

4、consumer服务消费端

封装HttpClient对象，发起远程调用

```
public class HttpClient{

    /**
     * 远程方法调用
     * @param hostname 远程主机名
     * @param port 远程主机端口
     * @param invocation
     * @return
     */
}
```




```
        try {
            // 进行http连接
            URL url = new URL("http",hostname,port,"/client/");
            HttpURLConnection connection =
            (HttpURLConnection)url.openConnection();
            connection.setRequestMethod("POST");
            connection.setDoOutput(true);// 必填项

            // 将对象写入输出流
            OutputStream os = connection.getOutputStream();
            ObjectOutputStream oos = new ObjectOutputStream(os);
            oos.writeObject(invocation);
            oos.flush();
            oos.close();

            // 将输入流转为字符串（此处可是java对象）
            InputStream is = connection.getInputStream();
            return IOUtils.toString(is);
        } catch (MalformedURLException e){
            e.printStackTrace();
        } catch (IOException e){
            e.printStackTrace();
        }
        return null;
    }
}
```

发送rpc调用测试

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

    // 调用哪个方法
    Invocation invocation = new Invocation(
        HelloService.class.getName(),
        "sayHello2",
        new Object[]{"学IT,来黑马"},
        new Class[]{String.class});

    // 发现服务器
    String result = new HttpClient().post("localhost", 8080, invocation);
    System.out.println(result);
}
```

###