

实验3： web服务开发与调用



实验内容：


基于 Apache Axis2 提供 Web 服务，生成 WSDL 文件，调用服务

- 1. **Web服务开发：** 下载Apache Axis2， 参照其文档将下面类的方法对外提供Web服务，生成 WSDL 文件；
- 2. **Web服务调用：** 通过网络调用上述Web服务的方法并获得返回结果， 其中输入参数name设置为自己学号；
- 3. **撰写实验报告：** 将整个实验过程的关键步骤进行描述并截图， 书写实验报告

1. 安装 Tomcat

Axis 2 需要依赖 Tomcat 提供 Web 服务，因此需要先搭建 Tomcat 服务器。

从 Tomcat 官网下载 tomcat 9.0.69 版本安装包，解压后运行 startup.sh 脚本：<https://tomcat.apache.org/download-90.cgi>



Apache Tomcat®

Apache Tomcat

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- Maven Plugin

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Tomcat 9 Software Downloads

Welcome to the Apache Tomcat® 9.x software download page. This page provides download links for obtaining the latest version of Tomcat 9.0.x software, as well as links to the archives of older releases.

Unsure which version you need? Specification versions implemented, minimum Java version required and lots more useful information may be found on the ["which version?"](#) page.

Quick Navigation

[KEYS](#) | [9.0.69](#) | [Browse](#) | [Archives](#)

Release Integrity

You **must** [verify](#) the integrity of the downloaded files. We provide OpenPGP signatures for every release file. This signature should be matched against the [KEYS](#) file which contains the OpenPGP keys of Tomcat's Release Managers. We also provide [SHA-512](#) checksums for every release file. After you download the file, you should calculate a checksum for your download, and make sure it is the same as ours.

Mirrors

You are currently using <https://d1cdn.apache.org/>. If you encounter a problem with this mirror, please select another mirror. If all mirrors are failing, there are *backup* mirrors (at the end of the mirrors list) that should be available.

Other mirrors:

9.0.69

Please see the [README](#) file for packaging information. It explains what every distribution contains.

Binary Distributions

- Core:
 - [zip](#) ([pgp](#), [sha512](#))
 - [tar.gz](#) ([pgp](#), [sha512](#))
 - [32-bit Windows zip](#) ([pgp](#), [sha512](#))
 - [64-bit Windows zip](#) ([pgp](#), [sha512](#))
 - [32-bit/64-bit Windows Service Installer](#) ([pgp](#), [sha512](#))
- Full documentation:
 - [tar.gz](#) ([pgp](#), [sha512](#))
- Deployer:
 - [zip](#) ([pgp](#), [sha512](#))
 - [tar.gz](#) ([pgp](#), [sha512](#))
- Embedded:
 - [tar.gz](#) ([pgp](#), [sha512](#))
 - [zip](#) ([pgp](#), [sha512](#))

Source Code Distributions

- [tar.gz](#) ([pgp](#), [sha512](#))
- [zip](#) ([pgp](#), [sha512](#))


启动tomcat服务后，访问 <http://localhost:8080>，
可以看到 Apache Tomcat 的初始界面，tomcat 搭建成功

← → ↻ ⓘ localhost:8080


Google 百度 工具 北航 学习 编程相关 资源 mev 娱乐 博士 其他书

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Apache Tomcat/9.0.69

 **APACHE** SOFTWARE FOUNDATION
<http://www.apache.org/>

If you're seeing this, you've successfully installed Tomcat. Congratulations!



Recommended Reading:

[Security Considerations How-To](#)

[Manager Application How-To](#)

[Clustering/Session Replication How-To](#)

Server Status

Manager App

Host Manager

Developer Quick Start

[Tomcat Setup](#)
[First Web Application](#)

[Realms & AAA](#)
[JDBC DataSources](#)

[Examples](#)

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Managing Tomcat

For security, access to the [manager webapp](#) is restricted. Users are defined in:

```
$CATALINA_HOME/conf/tomcat-users.xml
```

In Tomcat 9.0 access to the manager application is split between different users.
[Read more...](#)

[Release Notes](#)
[Changelog](#)
[Migration Guide](#)
[Security Notices](#)

Documentation

[Tomcat 9.0 Documentation](#)
[Tomcat 9.0 Configuration](#)
[Tomcat Wiki](#)

Find additional important configuration information in:

```
$CATALINA_HOME/RUNNING.txt
```

Developers may be interested in:

[Tomcat 9.0 Bug Database](#)
[Tomcat 9.0 JavaDocs](#)
[Tomcat 9.0 Git Repository at GitHub](#)

Getting Help

[FAQ and Mailing Lists](#)

The following mailing lists are available:

[tomcat-announce](#)
Important announcements, releases, security vulnerability notifications. (Low volume).

[tomcat-users](#)
User support and discussion

[taglibs-user](#)
User support and discussion for [Apache Taglibs](#)

[tomcat-dev](#)
Development mailing list, including commit messages

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Other Documentation

[Tomcat Connectors](#)
[mod_jk Documentation](#)
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2. 安装 axis2

Apache Axis2的官方文档为：<http://axis.apache.org/axis2/java/core/>
下载IDEA所需要的配置文件：<http://axis.apache.org/axis2/java/core/download.html>

AXIS2/JAVA

[Home](#)**Downloads**

Release Notes

[1.6.1](#)[1.6.2](#)[1.6.3](#)[1.6.4](#)[1.7.0](#)[1.7.1](#)[1.7.2](#)[1.7.3](#)[1.7.4](#)[1.7.5](#)[1.7.6](#)[1.7.7](#)[1.7.8](#)[1.7.9](#)[1.8.0](#)[1.8.1](#)[1.8.2](#)[Modules](#)

Releases

The current release is 1.8.2 and was published on July 14, 2022. The release note for this release can be found [here](#).

The following distributions are available for download:

	Link	Checksums and signatures
Binary distribution	axis2-1.8.2-bin.zip	SHA512 PGP
Source distribution	axis2-1.8.2-src.zip	SHA512 PGP
WAR distribution	axis2-1.8.2-war.zip	SHA512 PGP
Service Archive plugin for Eclipse	axis2.eclipse.service.plugin.1.8.2-dist.zip	SHA512 PGP
Code Generator plugin for Eclipse	axis2.eclipse.codegen.plugin-1.8.2-dist.zip	SHA512 PGP
Axis2 plugin for IntelliJ IDEA	axis2-idea-plugin-1.8.2.zip	SHA512 PGP

The binary distribution contains all the Axis2 libraries and modules, except for [Apache Rampart](#) (WS-Security implementation) which must be downloaded separately. It also contains command line tools, samples and scripts to start a standalone Axis2 server.

The WAR (Web Archive) distribution is designed for deployment on a servlet container.

The signatures of the distributions can be [verified](#) against the public keys in the [KEYS](#) file.

Maintenance releases from branches other than the main branch can be found [here](#). Distributions for older releases can be found in the [archive](#).

All releases are also available as Maven artifacts in the [central repository](#).

目前，axis2 最新的版本为 1.8.2，下载 `axis2-1.8.2-war.zip` 包，解包后可以获得一个 war 包

将该 war 包放置在 Tomcat 的 webapps 目录下，axis2 安装到 Tomcat 中。

此电脑 > 新加卷 (D:) > dev_tools > Apache Software Foundation > Tomcat 9.0 > webapps >

名称	修改日期	类型
axis2	2022/11/18 17:09	文件夹
docs	2022/11/18 17:01	文件夹
examples	2022/11/18 17:01	文件夹
host-manager	2022/11/18 17:01	文件夹
manager	2022/11/18 17:01	文件夹
ROOT	2022/11/18 17:01	文件夹
axis2.war	2022/7/13 21:55	WAR 文件

重启 Tomcat 访问 <http://127.0.0.1:8080/axis2/>，可以看到 axis2 的默认页面，axis2 环境搭建成功。



Welcome!

Welcome to the new generation of Axis. If you can see this page you have successfully deployed the Axis2 Web Application. However, to ensure that Axis2 is properly working, we encourage you to click on the validate link.

- [Services](#)
View the list of all the available services deployed in this server.
- [Validate](#)
Check the system to see whether all the required libraries are in place and view the system information.
- [Administration](#)
Console for administering this Axis2 installation.

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**3. **POJO 类实现



在Axis2中不需要进行任何的配置，就可以直接将一个简单的POJO发布成WebService。其中POJO中所有的public方法将被发布成WebService方法。

在 `<Tomcat安装目录>\webapps\axis2\WEB-INF\pojo</code> 目录中，建立 Person.java 文件，实现 Person 类：`

```
public class Person {
    String name;
    int age;
    boolean gender;

    public void setName(String name) {
        this.name = name;
    }

    public Person(String name, int age, boolean gender) {
        this.name = name;
        this.age = age;
        this.gender = gender;
    }

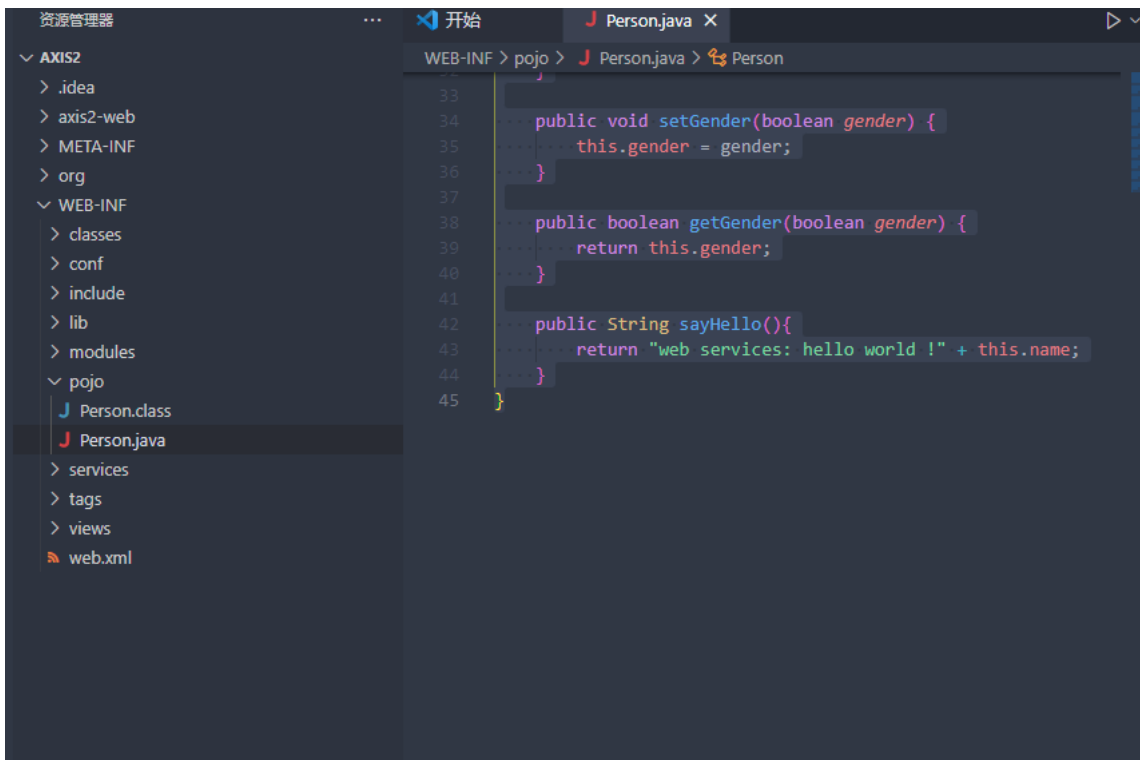
    public Person() {
        this.name = "None";
        this.age = 0;
        this.gender = true;
    }

    public String getName() {
        return name;
    }
}
```

启动命令行，在终端里边执行

```
javac Persion.java
```

生成Person.class文件

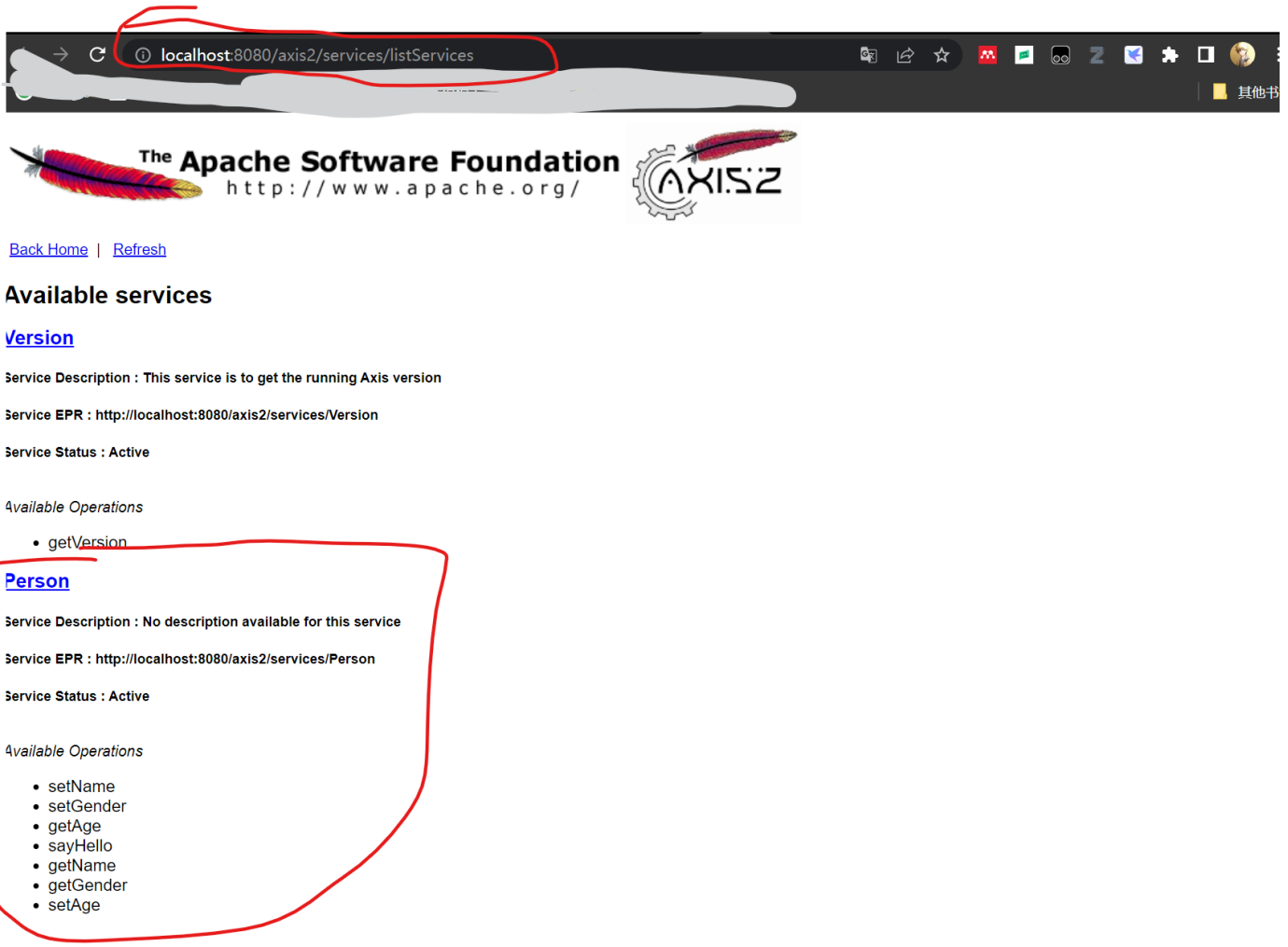


4. 测试服务调用

编译Person类后，将Person.class文件放到 <Tomcat安装目录>\webapps\axis2\WEB-INF\pojo 目录中（如果没有pojo目录，则建立该目录）。现在我们已经成功将Person类发布成了WebService。在浏览器地址栏中输入如下的URL：

<http://localhost:8080/axis2/services/listServices>

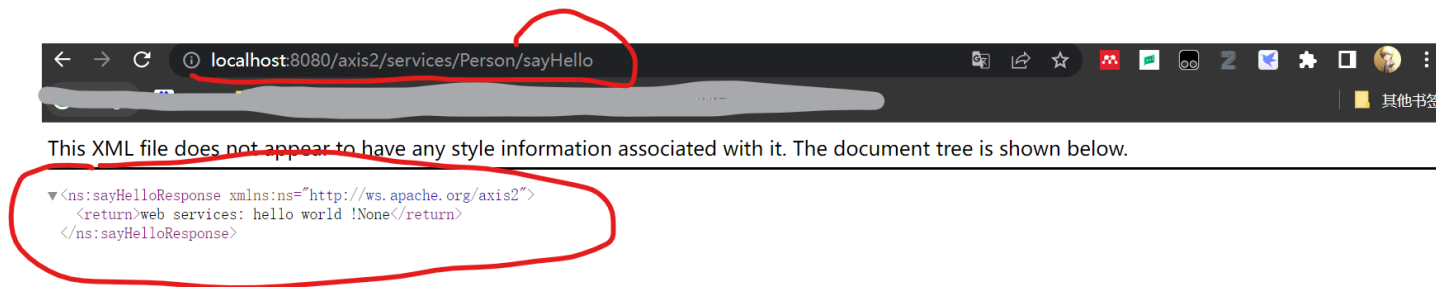
现在成功将 Person 类发布成了 WebService，在浏览器访问 <http://localhost:8080/axis2/services/listServices>



在浏览器地址栏中输入以下的URL来分别测试sayHello方法:

<http://localhost:8080/axis2/services/Person/sayHello>

页面显示如下结果:



5. 使用jar包形式实现WebService



用Axis2实现Web Service, 虽然可以将POJO类放在 `axis2\WEB-INF\pojo` 目录中直接发布成Web Service, 这样做不需要进行任何配置, 但这些POJO类不能在任何包中。这似乎有些不方便。

为此, Axis2也允许将带包的POJO类发布成Web Service。先实现一个POJO类, 代码如下:

```
    this.age = age;
}

public int getAge() {
    return age;
}

public void setGender(boolean gender) {
    this.gender = gender;
}

public boolean getGender(boolean gender) {
    return this.gender;
}

public String sayHello(){
    // 获得key-value对中的value
    MessageContext mc = MessageContext.getCurrentMessageContext();
    ServiceGroupContext sgc = mc.getServiceGroupContext();
    String name = (String) sgc.getProperty("name");
    String rs = String.format("web services: hello world ! %s", name);
    return rs;
}
}
```

要想将PersonService类发布成Web Service, 需要一个services.xml文件, 在项目下创建services文件夹然后创建 `META-INF-->services.xml`, services.xml这个文件必须要放在META-INF目录中, 该文件的内容如下:

```
<?xml version="1.0" encoding="UTF-8"?>

<service name="PersonService" scope="application" targetNamespace="http://ws.apache.org/axis2">
    <description>有状态 Person</description>
    <!-- 服务全类名 -->
    <parameter name="ServiceClass">com.buaa.PersonService</parameter>

    <messageReceivers>
        <!-- 配置消息接收器, Axis2会自动选择 -->
        <messageReceiver mep="http://www.w3.org/ns/wsdl/in-out"
            class="org.apache.axis2.rpc.receivers.RPCMessageReceiver" />
        <messageReceiver mep="http://www.w3.org/ns/wsdl/in-only"
            class="org.apache.axis2.rpc.receivers.RPCInOnlyMessageReceiver" />
    </messageReceivers>
</service>
```

其中 `<service>` 元素用于发布Web Service，一个 `<service>` 元素只能发布一个WebService类，name属性表示WebService名，如下面的URL可以获得这个WebService的WSDL内容：

<http://localhost:8080/axis2/services/PersonService?wsdl>

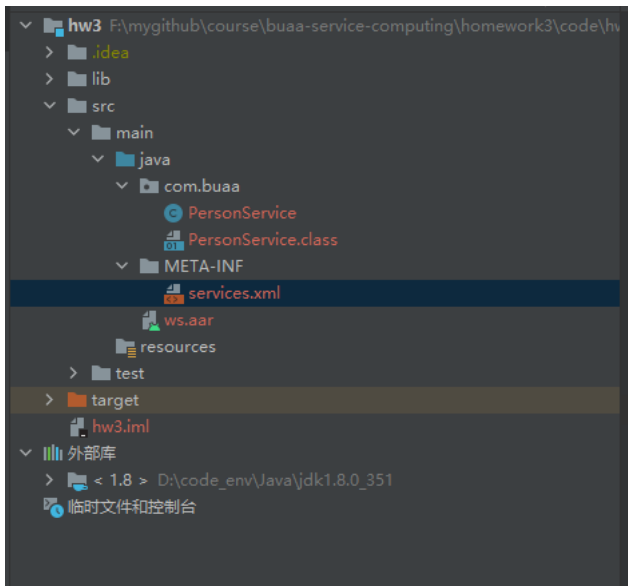
其中name属性名就是上面URL中“?”和“/”之间的部分。`<description>` 元素表示当前Web Service的描述，`<parameter>` 元素用于设置WebService的参数，在这里用于设置WebService对应的类名。在这里最值得注意的是 `<messageReceivers>` 元素，该元素用于设置处理WebService方法的处理器。

例如，sayHello方法有一个返回值，因此，需要使用可处理输入输出的RPCMessageReceiver类。

使用这种方式发布WebService，必须打包成.aar文件，.aar文件实际上就是改变了扩展名的.jar文件。

现在建立了两个文件：PersonService.java和services.xml。

将PersonService.java编译，生成PersonService.class。services.xml和HelloServiceNew.class文件的位置如下：



在windows控制台中进 `src/main/java` 目录，并输入如下的命令生成.aar文件。

`jar cvf ws.aar .` (`注意`：最后面是空格+小数点)



最后将ws.aar文件复制到 `<Tomcat安装目录>\webapps\axis2\WEB-INF\services` 目录中，启动Tomcat后，就可以调用这个WebService了。

访问<http://localhost:8080/axis2/services/listServices>



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Available services

[Version](#)

Service Description : This service is to get the running Axis version

Service EPR : <http://localhost:8080/axis2/services/Version>

Service Status : Active

Available Operations

- getVersion

[PersonService](#)

Service Description : ??? Person

Service EPR : <http://localhost:8080/axis2/services/PersonService>

Service Status : Active

Available Operations

- setName
- setGender
- getAge
- sayHello
- getName
- getGender
- setAge

访问: <http://localhost:8080/axis2/services/PersonService?wsdl>

如图所示:

This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
<?xml version="1.0" encoding="UTF-8" ?>
<wsdl:definitions xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/" xmlns:ns="http://buaa.com" xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:ns1="http://org.apache.axis2/xsd"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/" xmlns:http="http://schemas.xmlsoap.org/wsdl/http/"
xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/" xmlns:wsaw="http://www.w3.org/2006/05/addressing/wsdl" xmlns:tns="http://ws.apache.org/axis2" targetNamespace="http://ws.apache.org/axis2">
  <wsdl:documentation>有状态 Person</wsdl:documentation>
  <wsdl:types>
    <xs:schema attributeFormDefault="qualified" elementFormDefault="qualified" targetNamespace="http://buaa.com">
      <xs:element name="setName">
        <xs:complexType>
          <xs:sequence>
            <xs:element minOccurs="0" name="name" nillable="true" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="setGender">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="gender" type="xs:boolean"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="setAge">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="age" type="xs:int"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="sayHello">
        <xs:complexType>
          <xs:sequence/>
        </xs:complexType>
      </xs:element>
      <xs:element name="sayHelloResponse">
        <xs:complexType>
          <xs:sequence>
            <xs:element minOccurs="0" name="return" nillable="true" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="getName">
        <xs:complexType>
          <xs:sequence/>
        </xs:complexType>
      </xs:element>
      <xs:element name="getNameResponse">
        <xs:complexType>
          <xs:sequence>
            <xs:element minOccurs="0" name="return" nillable="true" type="xs:string"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="getGender">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="gender" type="xs:boolean"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="getGenderResponse">
        <xs:complexType>
          <xs:sequence>
            <xs:element name="return" type="xs:boolean"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="getAge">
        <xs:complexType>
          <xs:sequence/>
        </xs:complexType>
      </xs:element>
    </xs:schema>
  </wsdl:types>

```

首先:

<http://localhost:8080/axis2/services/PersonService/setName=by2221105>

然后访问: <http://localhost:8080/axis2/services/PersonService/sayHello>

结果如图所示, 成功将名称改为了学号

