A4M33AOS – Architektury orientované na služby

3. Web Services

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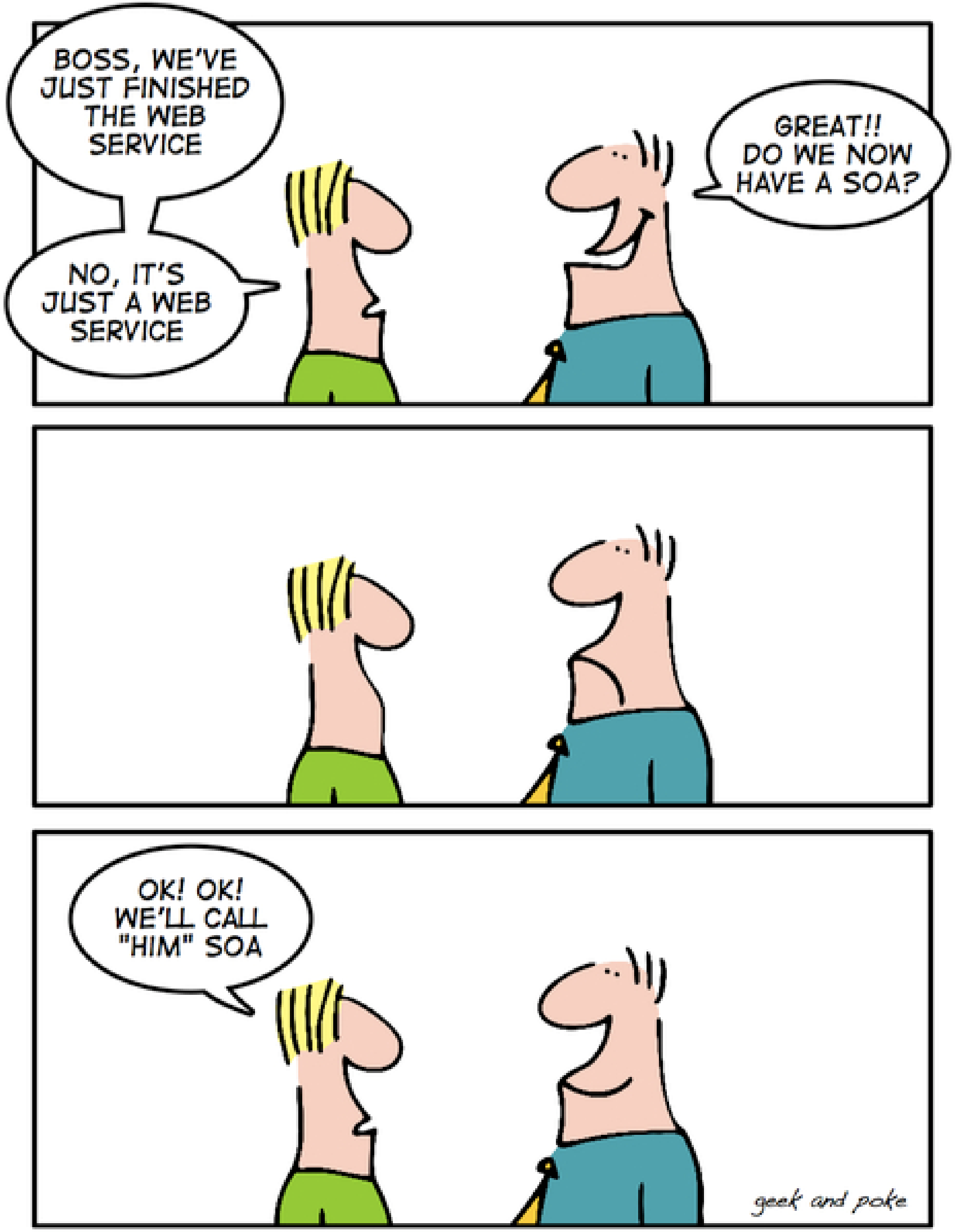

BOSS, WE'VE JUST FINISHED THE WEB SERVICE
GREAT!! DO WE NOW HAVE A SOA?
NO, IT'S JUST A WEB SERVICE
OK! OK! WE'LL CALL "HIM" SOA
geek and poke

HOW TO GET A SOA

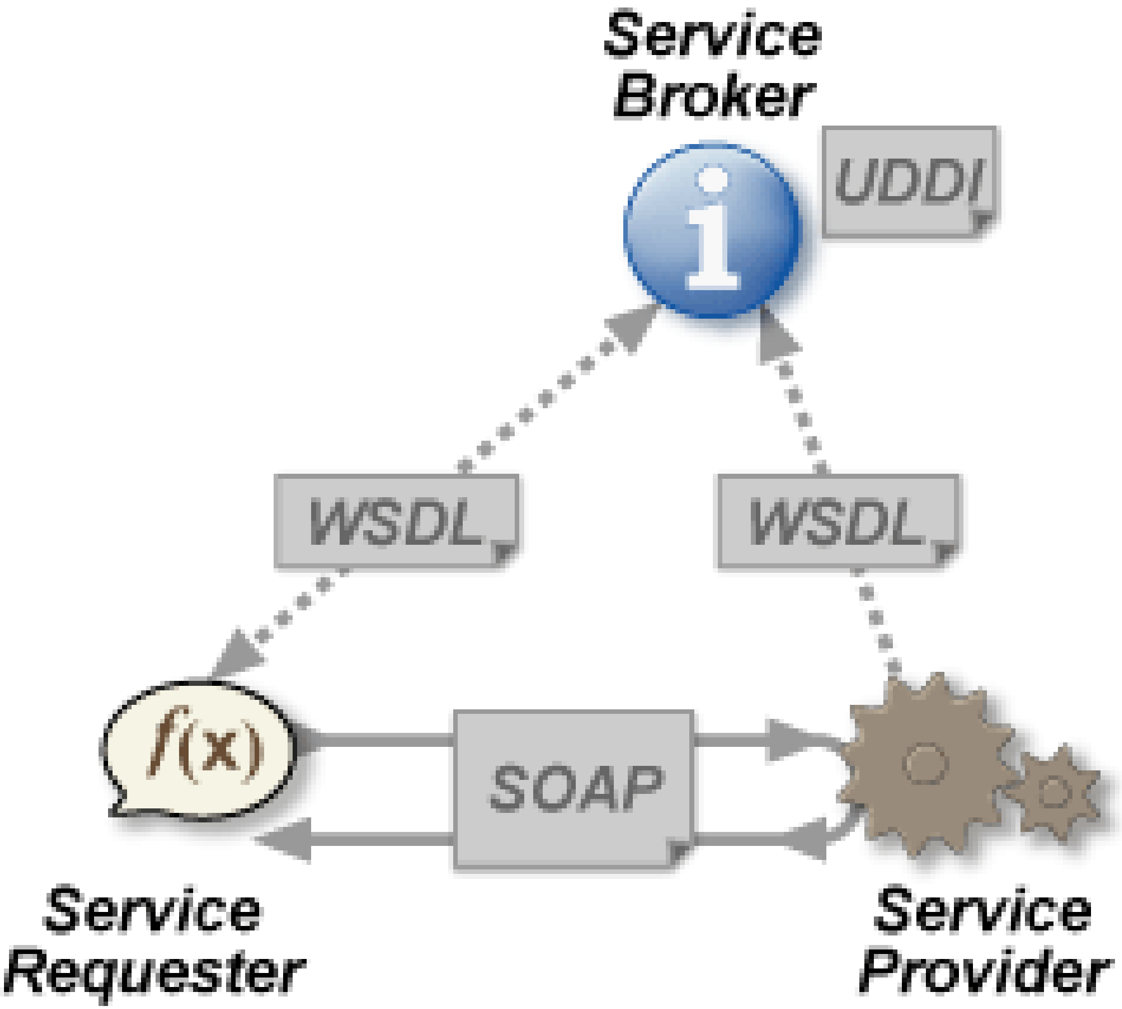
Web Services

- Application programming interfaces accessed via HTTP
- W3C definition – a software system designed to support interoperable machine-to-machine interaction over a network
- Interface described in a machine-processable format (WSDL)
- Interaction using SOAP messages using HTTP with XML

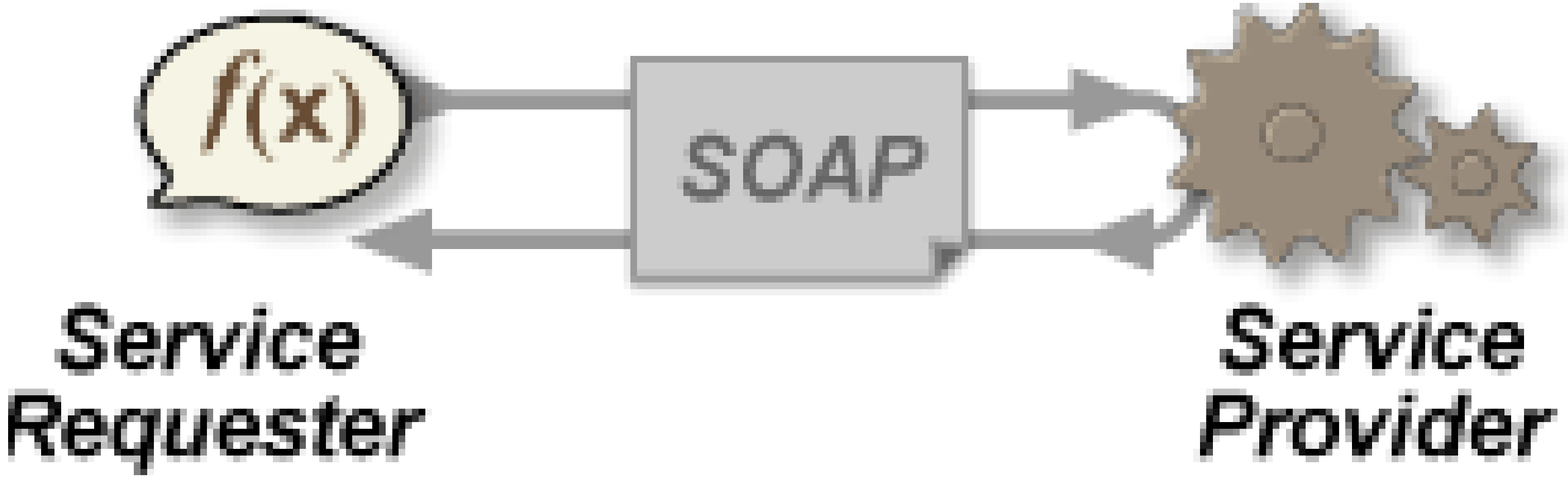
Web Services

- **RESTful Web services**
  - Primary purpose is to manipulate XML representations of Web resources
  - Uniform set of "stateless" operations
- **‘Big’ Web services**
  - Expose an arbitrary set of operations
  - Statefull

Web Services



RPC WS



- Distributed **method call** interface
- The first WS usages/tools
- Often implemented by mapping services directly to language-specific functions (not loosely coupled)

SOA WS

- Implemented according to SOA
- Basic unit of communication is a message – **message-oriented** services
- Loosely coupled
- Focus to WSDL ‘contract’
- More business oriented / event-driven SOA

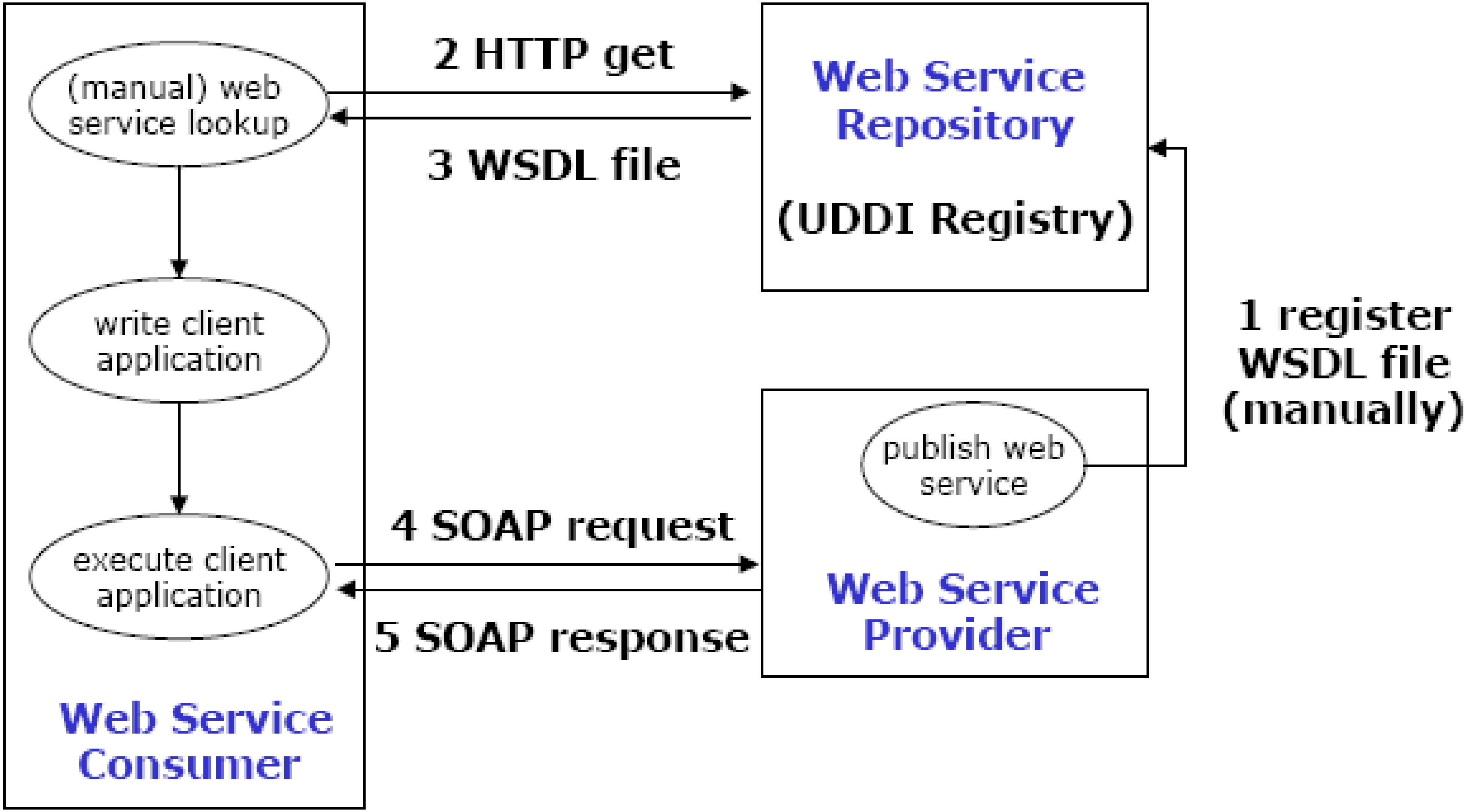
REST SOA

- Use HTTP or similar protocols by constraining the interface to a set of well-known, standard operations
- The focus is on interacting with **stateful resources**

WS Design

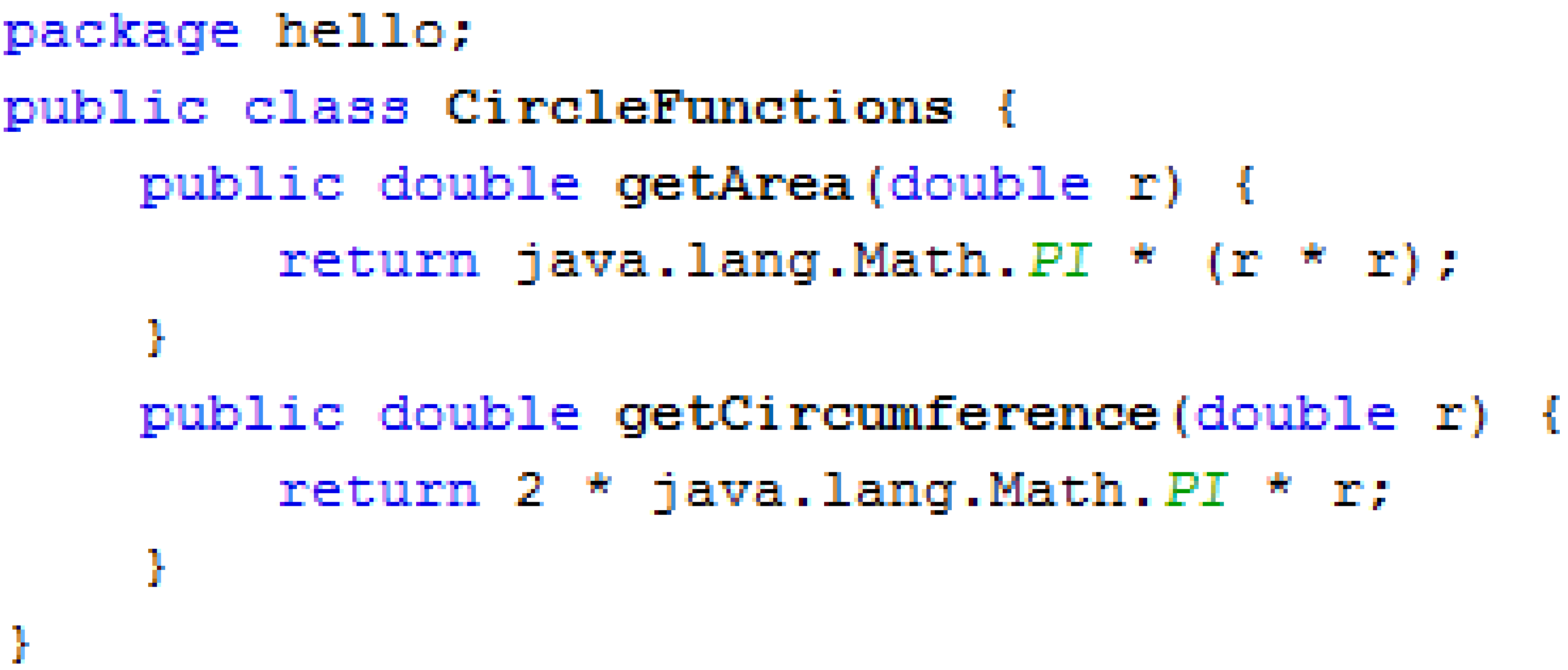
- Bottom up – first write the implementing class, then generate WSDL
  - Considered as simpler
  - Language/platform dependence/influence risk
- Top down – first write the WSDL document, then generate class skeleton
  - Considered as more difficult
  - Produce cleaner designs

WS Design


(manual) web service lookup
write client application
execute client application
Web Service Consumer
2 HTTP get
3 WSDL file
4 SOAP request
5 SOAP response
Web Service Repository
(UDDI Registry)
1 register WSDL file (manually)
publish web service
Web Service Provider

Bottom-up Service

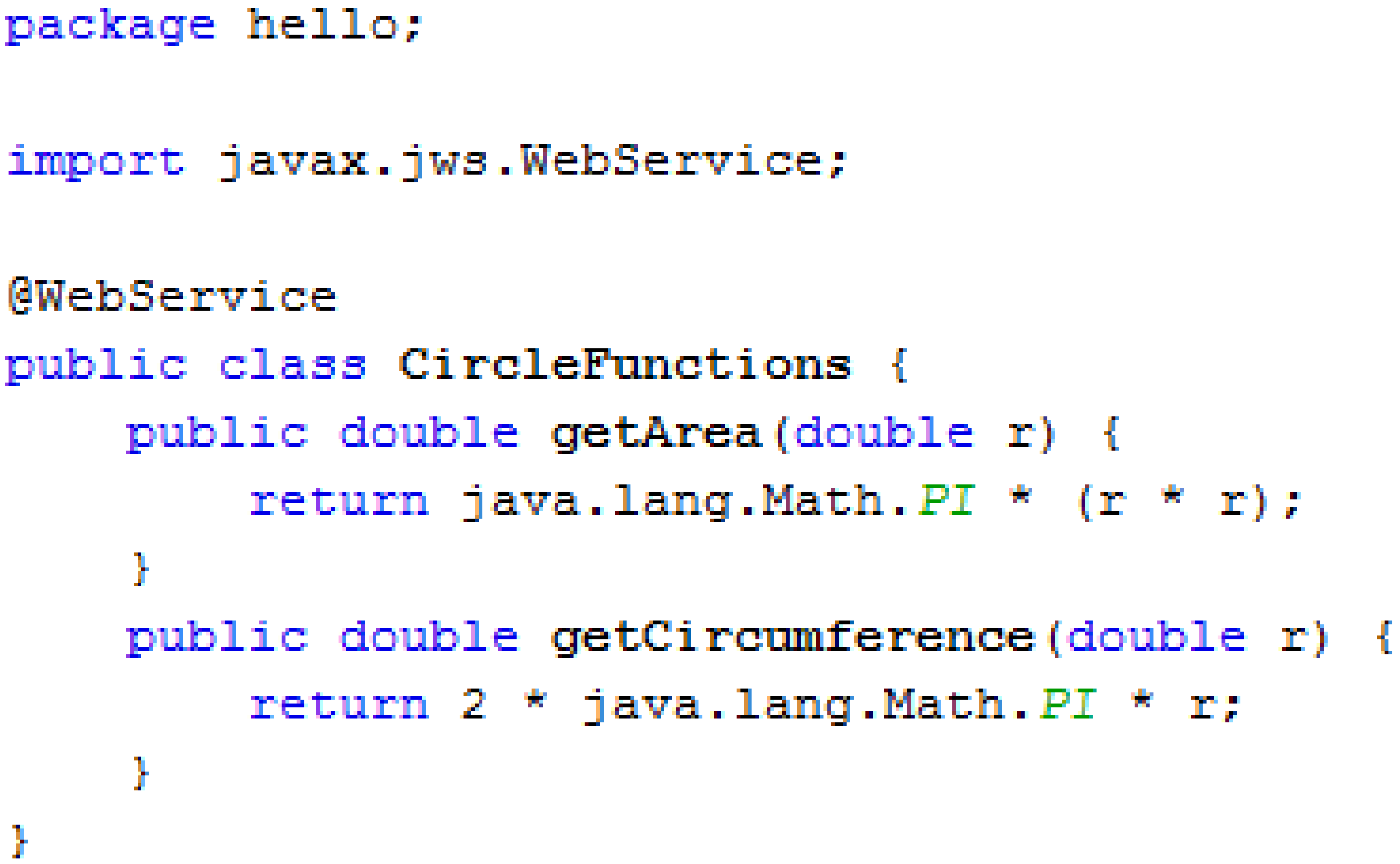
- http://java.sun.com/developer/technicalArticles/J2SE/jax_ws_2/
- **Code**



```
package hello;
public class CircleFunctions {
    public double getArea(double r) {
        return java.lang.Math.PI * (r * r);
    }
    public double getCircumference(double r) {
        return 2 * java.lang.Math.PI * r;
    }
}
```

Bottom-up Service

- **Annotate**



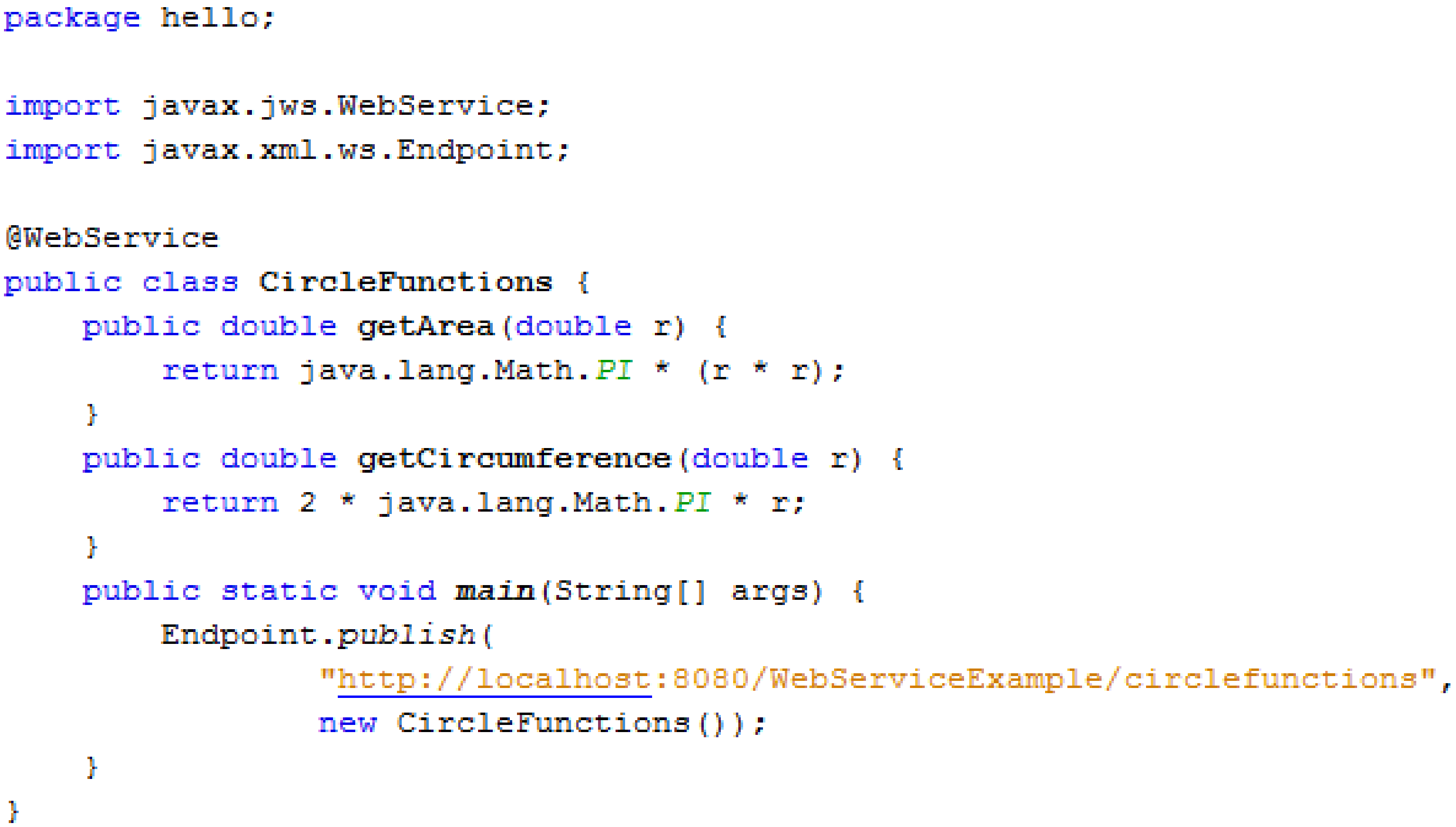
```
package hello;

import javax.jws.WebService;

@WebService
public class CircleFunctions {
    public double getArea(double r) {
        return java.lang.Math.PI * (r * r);
    }
    public double getCircumference(double r) {
        return 2 * java.lang.Math.PI * r;
    }
}
```

Bottom-up Service

- **Deploy**



```java
package hello;

import javax.jws.WebService;
import javax.xml.ws.Endpoint;

@WebService
public class CircleFunctions {
    public double getArea(double r) {
        return java.lang.Math.PI * (r * r);
    }
    public double getCircumference(double r) {
        return 2 * java.lang.Math.PI * r;
    }
    public static void main(String[] args) {
        Endpoint.publish(
                "http://localhost:8080/WebServiceExample/circlefunctions",
                new CircleFunctions());
    }
}
```

Bottom-up Service

- Code – CircleFunctions.java
- Compile – javac
- Generate service:

```
> wsgen -cp . hello.CircleFunctions
```

Bottom-up Service

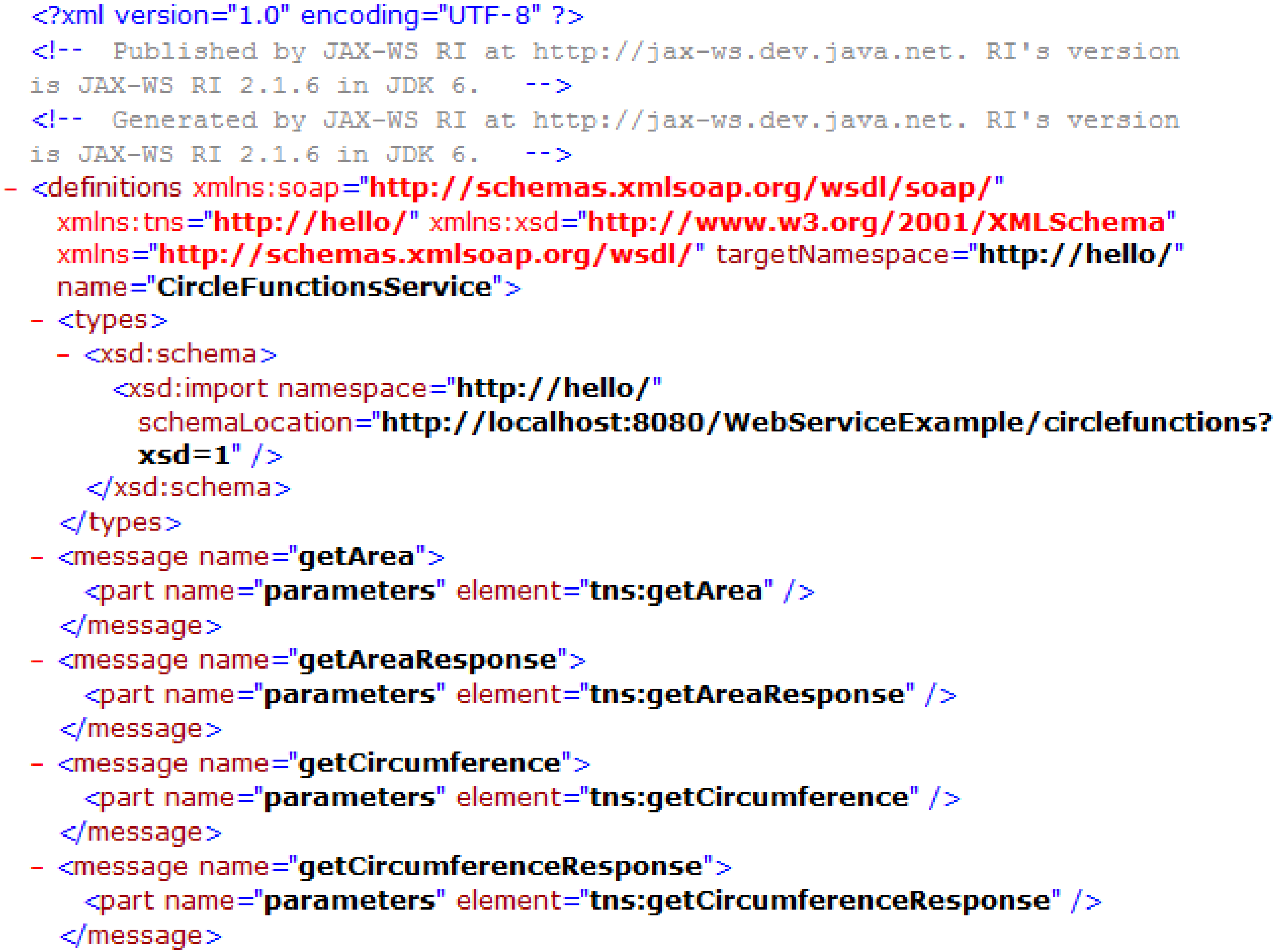
- Deploy:

```
> java hello.CircleFunctions
```

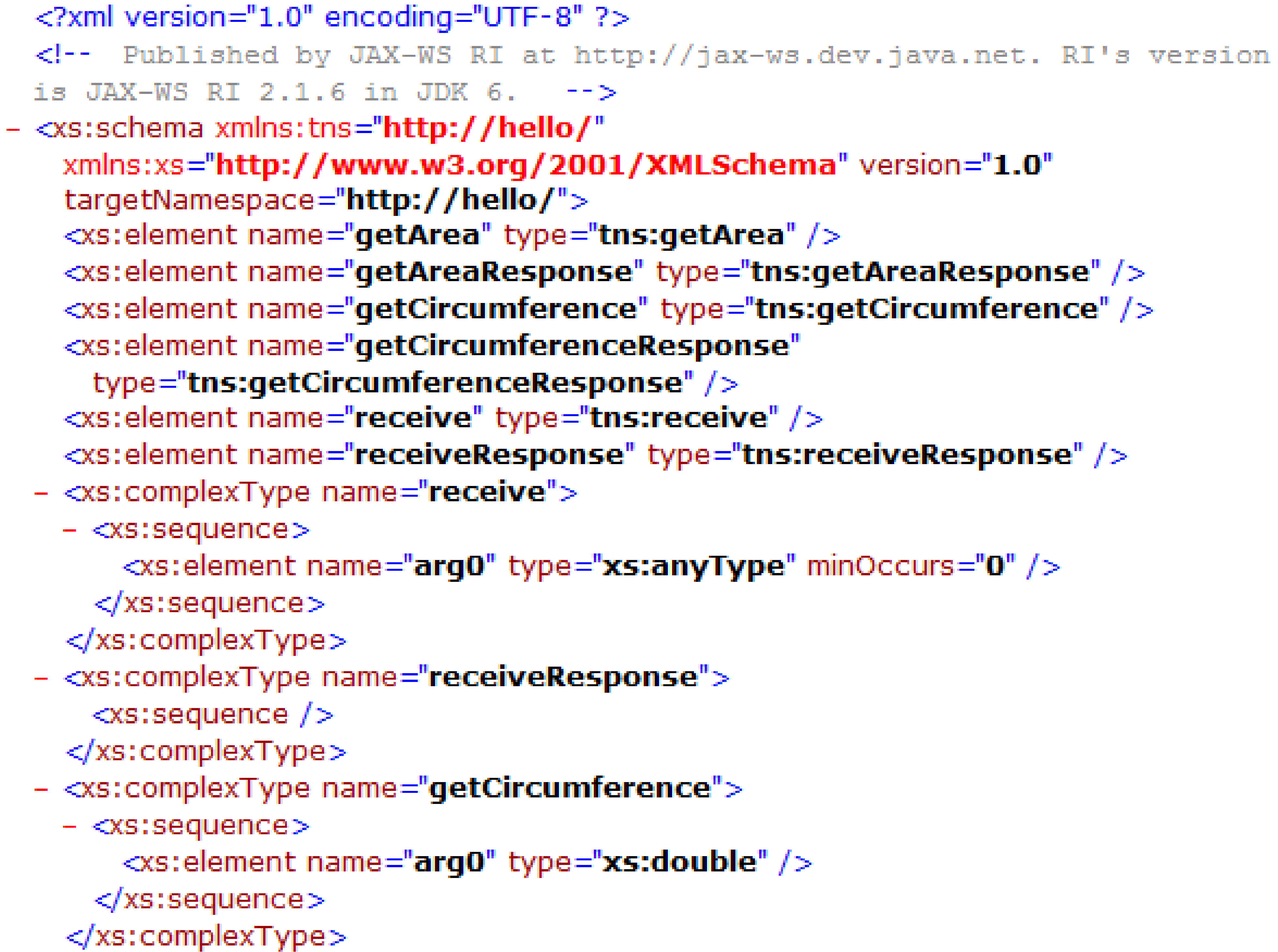
- Enjoy:

```
http://localhost:8080/WebServiceExample/circlefunctions?WSDL
```

```
http://localhost:8080/WebServiceExample/circlefunctions?xsd=1
```



```
  <?xml version="1.0" encoding="UTF-8" ?>
  <!--  Published by JAX-WS RI at http://jax-ws.dev.java.net. RI's version
  is JAX-WS RI 2.1.6 in JDK 6.   -->
  <!--  Generated by JAX-WS RI at http://jax-ws.dev.java.net. RI's version
  is JAX-WS RI 2.1.6 in JDK 6.   -->
- <definitions xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    xmlns:tns="http://hello/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns="http://schemas.xmlsoap.org/wsdl/" targetNamespace="http://hello/"
    name="CircleFunctionsService">
  - <types>
    - <xsd:schema>
        <xsd:import namespace="http://hello/"
          schemaLocation="http://localhost:8080/WebServiceExample/circlefunctions?
          xsd=1" />
      </xsd:schema>
    </types>
  - <message name="getArea">
      <part name="parameters" element="tns:getArea" />
    </message>
  - <message name="getAreaResponse">
      <part name="parameters" element="tns:getAreaResponse" />
    </message>
  - <message name="getCircumference">
      <part name="parameters" element="tns:getCircumference" />
    </message>
  - <message name="getCircumferenceResponse">
      <part name="parameters" element="tns:getCircumferenceResponse" />
    </message>
```



```
  <?xml version="1.0" encoding="UTF-8" ?>
  <!--  Published by JAX-WS RI at http://jax-ws.dev.java.net. RI's version
  is JAX-WS RI 2.1.6 in JDK 6.   -->
- <xs:schema xmlns:tns="http://hello/"
    xmlns:xs="http://www.w3.org/2001/XMLSchema" version="1.0"
    targetNamespace="http://hello/">
    <xs:element name="getArea" type="tns:getArea" />
    <xs:element name="getAreaResponse" type="tns:getAreaResponse" />
    <xs:element name="getCircumference" type="tns:getCircumference" />
    <xs:element name="getCircumferenceResponse"
      type="tns:getCircumferenceResponse" />
    <xs:element name="receive" type="tns:receive" />
    <xs:element name="receiveResponse" type="tns:receiveResponse" />
  - <xs:complexType name="receive">
    - <xs:sequence>
        <xs:element name="arg0" type="xs:anyType" minOccurs="0" />
      </xs:sequence>
    </xs:complexType>
  - <xs:complexType name="receiveResponse">
      <xs:sequence />
    </xs:complexType>
  - <xs:complexType name="getCircumference">
    - <xs:sequence>
        <xs:element name="arg0" type="xs:double" />
      </xs:sequence>
    </xs:complexType>
```

Bottom-up Service

- … even easier with IDE

Client

- Always top-down
- Generated stub from WSDL (`wsdl2java`)
- Really simple in IDE …

Top-down Service

- Corresponds to SOA model
- System design phase
- Various modeling tools
- XSD for data structures
- WSDL generated from model
- Supported by selected technologies/frameworks