CS 580 Client-Server Programming
Spring Semester, 2010
Doc 23 Web Services, REST & the rest
4 May 2010

Web Services

SOAP – Simple Object Access Protocol

1998 Created by Winer, Box, Atkinson, Al-Ghosein

Version 1.2 dropped the acronym

WSDL – Web Services Description Language

UUDI – Universal Description, Discovery and Integration of Web Services

UDDI

Registry for businesses worldwide to list themselves on the Internet

UDDI business registration consists of:

- White Pages — address, contact, and known identifiers;
- Yellow Pages — industrial categorizations based on standard taxonomies;
- Green Pages — technical information about services exposed by the business.

2005 - 70% of Fortune 500 companies plan to use UDDI

2006, January

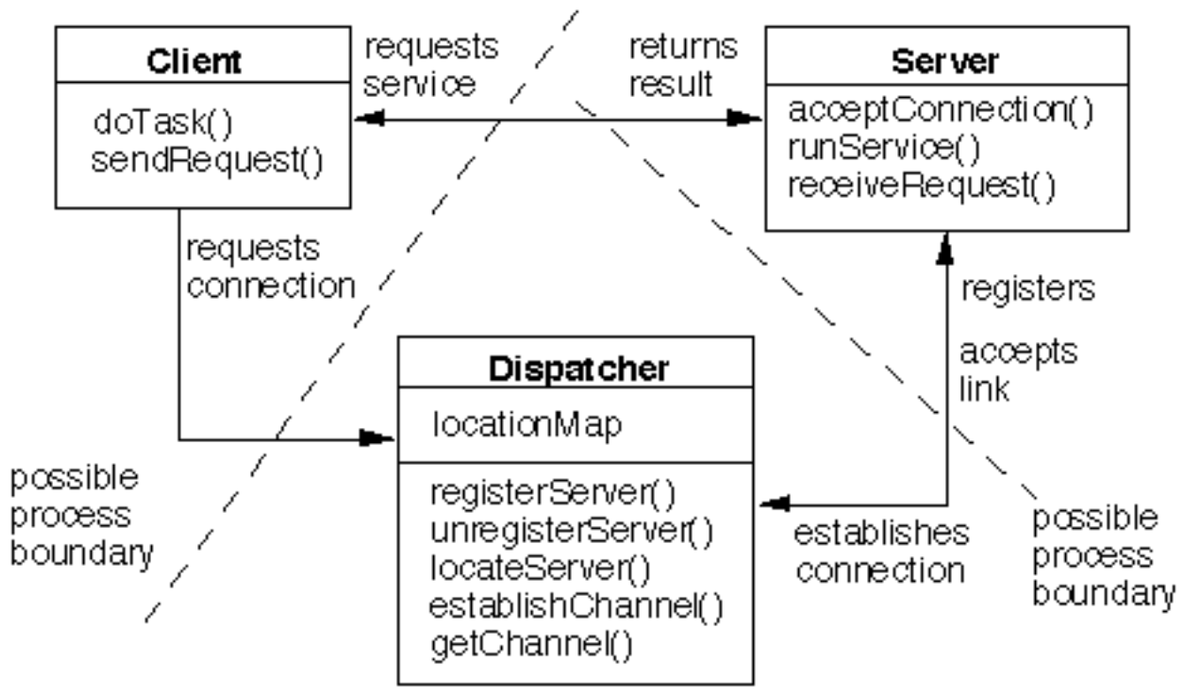
IBM, Microsoft shut down root UDDI servers

http://en.wikipedia.org/wiki/UDDI

UDDI Reborn

Plays the role of Dispatcher

Not clear how wide spread use is



WSDL

Description of how to interact with a Soap Server

Tools exist to

- Generate WSDL from a Server class
- Generate Server or client stub classes from WSDL

Sample Server

```
package samples.quickstart.service.pojo;

import java.util.HashMap;

public class StockQuoteService {
    private HashMap map = new HashMap();

    public double getPrice(String symbol) {
        Double price = (Double) map.get(symbol);
        if(price != null){
            return price.doubleValue();
        }
        return 42.00;
    }

    public void update(String symbol, double price) {
        map.put(symbol, new Double(price));
    }
}
```


Standard example from Apache Axis SOAP server

WSDL - Namespaces

```
?xml version="1.0" encoding="UTF-8"?>
<wsdl:definitions xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
xmlns:axis2="http://quickstart.samples/"
xmlns:ns1="http://org.apache.axis2/xsd"
xmlns:ns="http://quickstart.samples/xsd"
xmlns:wsaw="http://www.w3.org/2006/05/addressing/wsdl"
xmlns:http="http://schemas.xmlsoap.org/wsdl/http/"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/"
targetNamespace="http://quickstart.samples/">
```

Documentation & Types

```
<wsdl:documentation>StockQuoteService</wsdl:documentation>
<wsdl:types>
   <xs:schema attributeFormDefault="qualified" elementFormDefault="qualified" targetNamespace="http://quickstart.samples/xsd">
      <xs:element name="update">
         <xs:complexType>
            <xs:sequence>
               <xs:element minOccurs="0" name="symbol" nillable="true" type="xs:string"/>
               <xs:element minOccurs="0" name="price" type="xs:double"/>
            </xs:sequence>
         </xs:complexType>
      </xs:element>
      <xs:element name="getPrice">
         <xs:complexType>
            <xs:sequence>
               <xs:element minOccurs="0" name="symbol" nillable="true" type="xs:string"/>
            </xs:sequence>
         </xs:complexType>
      </xs:element>
      <xs:element name="getPriceResponse">
         <xs:complexType>
            <xs:sequence>
               <xs:element minOccurs="0" name="return" type="xs:double"/>
            </xs:sequence>
         </xs:complexType>
      </xs:element>
   </xs:schema>
</wsdl:types>
```

Message & PortType

```
<wsdl:message name="getPriceRequest">
   <wsdl:part name="parameters" element="ns:getPrice"/>
</wsdl:message>
<wsdl:message name="getPriceResponse">
   <wsdl:part name="parameters" element="ns:getPriceResponse"/>
</wsdl:message>
<wsdl:message name="updateRequest">
   <wsdl:part name="parameters" element="ns:update"/>
</wsdl:message>
<wsdl:portType name="StockQuoteServicePortType">
   <wsdl:operation name="getPrice">
      <wsdl:input message="axis2:getPriceRequest" wsaw:Action="urn:getPrice"/>
      <wsdl:output message="axis2:getPriceResponse" wsaw:Action="urn:getPriceResponse"/>
   </wsdl:operation>
   <wsdl:operation name="update">
      <wsdl:input message="axis2:updateRequest" wsaw:Action="urn:update"/>
   </wsdl:operation>
</wsdl:portType>
```

SOAP 1.1 Binding

```
<wsdl:binding name="StockQuoteServiceSoap11Binding"
type="axis2:StockQuoteServicePortType">
    <soap:binding transport="http://schemas.xmlsoap.org/soap/http" style="document"/>
    <wsdl:operation name="getPrice">
        <soap:operation soapAction="urn:getPrice" style="document"/>
        <wsdl:input>
            <soap:body use="literal"/>
        </wsdl:input>
        <wsdl:output>
            <soap:body use="literal"/>
        </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="update">
        <soap:operation soapAction="urn:update" style="document"/>
        <wsdl:input>
            <soap:body use="literal"/>
        </wsdl:input>
    </wsdl:operation>
</wsdl:binding>
```

SOAP 1.2 Binding

```
<wsdl:binding name="StockQuoteServiceSoap12Binding"
                    type="axis2:StockQuoteServicePortType">
    <soap12:binding transport="http://schemas.xmlsoap.org/soap/http" style="document"/>
    <wsdl:operation name="getPrice">
       <soap12:operation soapAction="urn:getPrice" style="document"/>
       <wsdl:input>
          <soap12:body use="literal"/>
       </wsdl:input>
       <wsdl:output>
          <soap12:body use="literal"/>
       </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="update">
       <soap12:operation soapAction="urn:update" style="document"/>
       <wsdl:input>
          <soap12:body use="literal"/>
       </wsdl:input>
    </wsdl:operation>
</wsdl:binding>
```

Http Binding

```
<wsdl:binding name="StockQuoteServiceHttpBinding"
type="axis2:StockQuoteServicePortType">
    <http:binding verb="POST"/>
    <wsdl:operation name="getPrice">
      <http:operation location="StockQuoteService/getPrice"/>
      <wsdl:input>
        <mime:content type="text/xml" part="getPrice"/>
      </wsdl:input>
      <wsdl:output>
        <mime:content type="text/xml" part="getPrice"/>
      </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="update">
      <http:operation location="StockQuoteService/update"/>
      <wsdl:input>
        <mime:content type="text/xml" part="update"/>
      </wsdl:input>
    </wsdl:operation>
</wsdl:binding>
```

Port Location

```
<wsdl:service name="StockQuoteService">
   <wsdl:port name="StockQuoteServiceHttpSoap11Endpoint"
                        binding="axis2:StockQuoteServiceSoap11Binding">
      <soap:address location="http://localhost:8080/axis2/services/
                  StockQuoteService.StockQuoteServiceHttpSoap11Endpoint/"/>
   </wsdl:port>
   <wsdl:port name="StockQuoteServiceHttpSoap12Endpoint"
                  binding="axis2:StockQuoteServiceSoap12Binding">
      <soap12:address location="http://localhost:8080/axis2/services/
                  StockQuoteService.StockQuoteServiceHttpSoap12Endpoint/"/>
      </wsdl:port>
      <wsdl:port name="StockQuoteServiceHttpEndpoint"
                        binding="axis2:StockQuoteServiceHttpBinding">
         <http:address location="http://localhost:8080/axis2/services/
                  StockQuoteService.StockQuoteServiceHttpEndpoint/"/>
      </wsdl:port>
   </wsdl:service>
</wsdl:definitions>
```

Good News

Given Server class tools will generate WSDL

Given WSDL tools will generate stub for

- Server
- Client

Bad News

Stub for Java Client for server example is 2,000 lines long

It can be seperated into multiple classes

SOAP

Exchanging XML messages over computer network

Message Exchange Patterns

- RPC - Remote procedure call
- Document - one way message

Transport

- HTTP, HTTPS, SMTP

Data types Supported

- All base Schema types
- Struct
- Array

Sample Ruby Client

```
require 'soap/wsdlDriver'

proxy = SOAP::WSDLDriverFactory.new("http://www.eli.sdsu.edu/courses/spring07/cs580/Hello.wsdl").createDriver
puts proxy.Hello('Roger')
```

Some Performance

Time in seconds

	Connect time	Send String 21,000 Chars	Send 5,000 integers	Server LOC	Message size sending 100 integers
socket	0.002242	0.001377	6.71	25	85,863
Corba	0.000734	0.004601	1.52	18	27,181
XML-RPC	0.007040	0.082755	100.34	17	324,989
SOAP	0.000610	0.294198	1,324.30	10	380,288

Factor slower/larger than using Socket

	Connect time	Send String 21,000 Chars	Send 5,000 integers	Server LOC	Message size sending 100 integers
Corba	0.3	3.3	0.2	0.7	0.3
XML-RPC	3.1	60.1	15.0	0.7	3.8
SOAP	0.3	213.7	197.4	0.4	4.4

Code written in Python

http://www-128.ibm.com/developerworks/webservices/library/ws-pyth9/

REST

http://developers.slashdot.org/article.pl?sid=03/04/03/1942235&mode=nocomment&tid=185&tid=156

tadghin:

“I was recently talking with Jeff Barr, creator of syndic8 and now Amazon's chief web services evangelist. He let drop an interesting tidbit. Amazon has both SOAP and REST interfaces to their web services, and 85% of their usage is of the REST interface."

" Despite all of the corporate hype over the SOAP stack, this is pretty compelling evidence that developers like the simpler REST approach. “

History

Roy Fielding

2000 Ph.D. Thesis

Architectural Styles and the Design of Network-based Software Architectures

What makes the Web scale?

REST Principles

Application state and functionality are abstracted into resources

Resource is uniquely addressable using a link

All resources share a uniform interface for the transfer of state between client and resource, consisting of

- A constrained set of well-defined operations
- A constrained set of content types, optionally supporting code on demand

A protocol which is:

- Client-server
- Stateless
- Cacheable
- Layered

Two Meanings of REST

1

Fielding's definition

2

Any simple interface which transmits domain-specific data over HTTP

Web & Decline of Client-Server Programming

Web

- Thin clients
- Easy to deploy

But ...

What is SMS? Chat?

Amazon Services

Google services

Cloud Computing

Clusters of machine providing a service

Example: Amazon's cloud computing cluster

Third party provide machines to support servers for service

Service is accessed via client, often Web Browser

Mobile Computing

46 out of 66 apps on my phone are clients