



# Web Services

Presentation: Andreas Gampe

Distributed Computing

Web services

Core Specifications

Advantages & Problems

Hands-on

References



## Distributed Computing

- ▶ Single computer  $\longrightarrow$  Networked world
- ▶ Communication allows dividing up work
- ▶ Two basic architectures
  - ▶ Shared memory
  - ▶ Message passing

## RPC

- ▶ Restrict to:
  - ▶ Client - Server model
  - ▶ Static, public interfaces
- ▶ This allows:
  - ▶ Method calls as a more comfortable invocation
  - ▶ Hiding low-level technicalities
- ▶ Remote Procedure Call
- ▶ RFC 707, 1976

## RPC - Some implementations

- ▶ Xerox Courier
- ▶ ONC RPC
- ▶ DCE/RPC
- ▶ MSRPC
- ▶ CORBA

## RPC - Some problems

- ▶ Interoperability
- ▶ Firewalls
  - ▶ Binary encoding
  - ▶ Ports
- ▶ Complexity
- ▶ Availability

## Web services

- ▶ World Wide Web Consortium (W3C):  
"A software system designed to support interoperable Machine to Machine interaction over a network."
- ▶ Mostly used as RPC over the internet
- ▶ "Web service" encompasses three activities
  - ▶ Find a Web service
  - ▶ Understand the Web service
  - ▶ Communicate with the Web service
- ▶ All based on XML

# XML

- ▶ Extensible Markup Language
  - ▶ Markup: text + extra information (structure, layout ...)
  - ▶ Extensible: allows new tags
- ▶ Simplified rework of SGML
- ▶ Base of many sub-languages
  - ▶ XHTML, RSS, SVG, ODF
- ▶ Fee-free, open standard

## XML (cont.)

- ▶ Well-formed document
  - ▶ Follows the syntactic rules
- ▶ Valid document
  - ▶ Follows some additional constraints (structure, content)
  - ▶ Described by a schema
- ▶ Example

```

<book title="I Am America (And So Can You!)" >
  <part name="Preface" >
    ...
  </part>
</book>
```

## UDDI

- ▶ Universal Description Discovery and Integration
- ▶ OASIS, 2000
- ▶ Registry protocol
  - ▶ Classify, catalog & manage Web services
- ▶ Early work: "UDDI Business Registry" (UBR) = global master directory
- ▶ Implemented as a Web service

## UDDI - Services

- ▶ Businesses, organizations (or generalized providers)
- ▶ available Web services
- ▶ technical interfaces = WSDLs
- ▶ UBR:
  - ▶ White Pages: address, contact ...
  - ▶ Yellow Pages: industrial categorizations
  - ▶ Green Pages: technical information

## WSDL

- ▶ Web Service Description Language
- ▶ W3C recommendation
- ▶ XML-based
- ▶ Describes public interface
- ▶ Also describes used protocols
- ▶ Used for automatic code generation

## WSDL - Example

```

<wsdl:definitions>
  <wsdl:types>
    ...
  </wsdl:types>
  <wsdl:portType name="Service">
    <wsdl:operation name="method1">
      <wsdl:input ... >
      <wsdl:output ... >
    </wsdl:operation>
  </wsdl:portType>
  <wsdl:binding>
    ...
  </wsdl:binding>
  <wsdl:service name="MyService">
    <wsdl:port>
      <wsdlsoap:address location="...">
    </wsdl:port>
  </wsdl:service>
</wsdl:definitions>
  
```

- ▶ Operation: remote procedure
- ▶ Port Type: collection of ops
- ▶ Port: Port Type + Address
- ▶ Web service: collection of endpoints

## SOAP

- ▶ Simple Object Access Protocol
- ▶ Message exchange using XML
- ▶ 1998, with support from MS, today W3C
- ▶ "Binding": specification for transport
  - ▶ HTTP(S)
  - ▶ SMTP

## SOAP - Example

```

<env:Envelope>
  <env:Header>
    <n:alert priority="1" / >
  </env:Header>
  <env:Body>
    <m:alert>
      Pick up paycheck at 2pm
    </m:alert>
  </env:Body>
</env:Envelope>
  
```

- ▶ Envelope: whole message
- ▶ Header: additional information for receiver
- ▶ Body: message payload

## Other specs

- ▶ Web Service - Interoperability (WS-I)
  - ▶ Profiles = set of core specifications
  - ▶ Most common: WS-I Basic Profile
- ▶ More than 30 other specifications
  - ▶ Deal with special cases
  - ▶ Extend capabilities

## Advantages

- ▶ Big community
- ▶ Free software available
- ▶ XML
  - ▶ Internationalization
  - ▶ Many standard tools
- ▶ Document style: improvements to traditional RPC

## Problems

- ▶ XML:
  - ▶ Verbose → big, slow
- ▶ SOAP & WSDL
  - ▶ New client code for new Web service
  - ▶ Alternative: RESTful Web services
- ▶ UDDI
  - ▶ Only extremely simple text searches
  - ▶ Semantic Description?

## Frameworks

- ▶ Many frameworks available
  - ▶ Java: Apache Axis, Apache CXF, Java Web Services Developer Pack ...
  - ▶ .NET: Windows Communication Foundation
  - ▶ C++: Apache Axis, gSOAP
  - ▶ PHP: NuSOAP
  - ▶ Python: pywebsvcs
  - ▶ ...

## Frameworks (cont.)

- ▶ Frameworks usually allow to build a Web service (client) from a WSDL or existing code
- ▶ May use introspection
- ▶ Allow fast development
- ▶ Let's see how it's done in Eclipse...

## Some simple free Web services

- ▶ Quote For Today  
<http://www.saintbook.org/MightyMaxims/MightyMaxims.asmx?WSDL>
- ▶ Cookpedia recipe  
<http://www.saintbook.org/MightyMeals/MightyMeals.asmx?WSDL>
- ▶ Names and Gender  
<http://www.thomas-bayer.com/names-service/soap?wsdl>



## Various Authors

*Wikipedia articles on XML, Web service, SOAP, WSDL, UDDI.*

Wikipedia, <http://en.wikipedia.org>



## Various Authors

*W3C Specifications and Recommendations for XML, SOAP, WSDL.*

World Wide Web Consortium, <http://www.w3.org>