# Lecture 5.d

## Web Services I
## Communication Models

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17.02.2021

# Web Service Communication Modes

# Web Service
# Communication Modes (1)

**Function oriented: RPC (Remote Procedure Calls)**

- **Distributed function call interface**
- **Widely deployed and supported, but not loosely coupled**
- **Basic communication unit: WSDL operation**
- **Other approaches: CORBA, DCE/RPC, Java RMI**

# Web Service
# Communication Modes (1)

Message oriented: SOA (Service-Oriented Architecture)

- basic communication unit: message, rather than an operation

Resource oriented: REST (Representational State Transfer)

- Standard operations in HTTP: GET, POST, PUT, DELETE
- Interacting with stateful resources, rather than messages or operations

# Web Service Communication Modes (2)

## Function Oriented Communication

- Web Service request is a method or a procedure call with associated input and output parameters that can be simple data types or complex objects, in which case the objects have to be serialized as bits and bytes when traversing through the Internet

- The service consumer sends a message formatted specifically to be mapped to a web service using XML to marshal data

- If a response is available, the web service returns an XML message that must be un-marshalled, if there is no response the return message indicates the problem

# Web Service Communication Modes (2)

## Function Oriented communication

- Implemented as XML-RPC to support a simplistic, yet viable invocation model over the Internet using HTTP

- The request and the reply are modelled as synchronous messages, i.e. an application sends a message and waits for a response (request-response mode)

- RPC-oriented interactions are good for brief data exchanges

# Web Service
# Communication Modes (3)

**Function oriented communication: example**

**XML RPC request**

```
<?xml version='1.0' encoding='UTF-8'?>
<SOAP-ENV:Envelope xmlns:SOAP-
    ENV="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <SOAP-ENV:Body>
      <ns1:getAddress  xmlns:ns1="urn:oracle-j2ee-ws_example-
          StatelessExample" SOAP-
          ENV:encodingStyle="http://schemas.xmlsoap.org/soap/en
          coding/">
          <param0 xsi:type="xsd:string">w1w 6uw</param0>
      </ns1:getAddress>
      </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

# Web Service
# Communication Modes (3)

**XML RPC response**

```
<?xml version='1.0' encoding='UTF-8'?>
<SOAP-ENV:Envelope xmlns:SOAP-
    ENV="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema">
    <SOAP-ENV:Body>
      <ns1:getAddressResponse xmlns:ns1="urn:oracle-j2ee-
          ws_example-StatelessExample" SOAP-
          ENV:encodingStyle="http://schemas.xmlsoap.org/soap/en
          coding/">
          <return xsi:type="xsd:string">115 New Cavendish
          Street</return>
      </ns1:getAddressResponse>
    </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

# Web Service Communication Modes (4)

## Message- (or document-) oriented communication

- Web Service request is a complete XML document that is intended to be processed whole and during the communication a complete document might be exchanged

- Document-Oriented interactions are data-oriented communications that often assume that the service consumers and providers have agreed to share a common business document, such as a purchase order or an invoice

# Web Service
# Communication Modes (4)

## Message- (or document-) oriented communication

- These parties also typically agree on a common process flow, or interaction patterns for exchanging the shared document
- If the document is already held in common, fragments of information required to fill in specific sections of the shared document, such as purchase price or promised delivery date, might be exchanged
- Document-oriented interactions are suitable for bulk data exchanges

# Web Service
# Communication Modes (5)

## Message (or Document)-oriented communication: example

**document sent in the request**

```
<?xml version='1.0' encoding='UTF-8'?>
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:xsd="http://www.w3.org/2001/XMLSchema">

<SOAP-ENV:Body>
    xmlns ="http://university.com/staff-schema"
    xsi:schemaLocation="http://university.com/contact-schema.xsd">

    <university:getContact>
        <organisation>
            <employee>
                <name>Gabriele Pierantoni</name>
                <post>Lecturer</post>
                <emp_id>1234</emp_id>
                <faculty>Science and Technology</faculty>
                <department>Computer Science</department>
            </employee>
        </organisation>
    </university:getContact>
</SOAP-ENV:Body>
```

# Web Service
# Communication Modes (6)

## Message (or Document)-oriented communication: example

**document received in the response**

```
<?xml version='1.0' encoding='UTF-8'?>
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:xsd="http://www.w3.org/2001/XMLSchema">

   <SOAP-ENV:Body>
   xmlns ="http://university.com/staff-schema"
   xsi:schemaLocation="http://university.com/contact-schema.xsd">

      <university:getContact>
         <employee>
            <name>Gabriele Pierantoni</name>
               <contact>
                  <phone>2079115000</phone>
                  <email>pierang@westminster.ac.uk/email>
               </contact>
         </employee>
      </university:getContact>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

# Web Service
# Communication Modes (7)

## Resource-oriented communication

- REST request is a simple HTTP request just like a regular browser would send to a Web Server

- There is typically no XML request sent

- REST response is typically an XML document sent back in a regular HTTP response, just as if a browser had requested it.

# Web Service
# Communication Modes (8)

## Resource-oriented communication: example

### RESTful request

```
GET /http://westminster.ac.uk/staff/Pierantoni/contacts HTTP /1.1
Host: westminster.ac.uk
Accept: application/xml
```

### RESTful reply

```
HTTP/1.1 202 Accepted Content-Type: application/xml; charset=UTF-8
Content-Location: http://westminster.ac.uk/staff/Pierantoni/contacts
<profile>
   <firstName>Gabriele</firstName>
   <lastName>Pierantoni</lastName>
         <contact>
            <phone>2079115000</phone>
            <email>pierang@westminster.ac.uk/email>
         </contact>
</profile>
```