Tutorial I

Web Services

1. What is a Web Service?
2. An example Web Service
3. OmniEditor: Wrapping a text editor into a WS
4. OmniGraphEditor: supporting a graphic editor

References
Gustavo Alonso, Fabio Casati, Karumi Kuno, Vijay Machiraju. *Web Services, Concepts, Architectures and Applications.* Springer-Verlag, 2004.

OmniEditor is a result of the course project for CSC408H.

What is Web Service

- Historic perspectives
  - Centralized versus Distributed Programming Models: Client/Server, Master/Slave, SPMD, etc…
  - Middleware architecture
    2-tier, 3-tier, n-tier
  - Technical evolution
    - IPC (inter process call):
      RPC, Java RMI, CORBA, DCOM
    - Shared Memory, Distributed Shared Memory and Message Passing
- Interoperability, interoperability, interoperability

What is a Web Service?

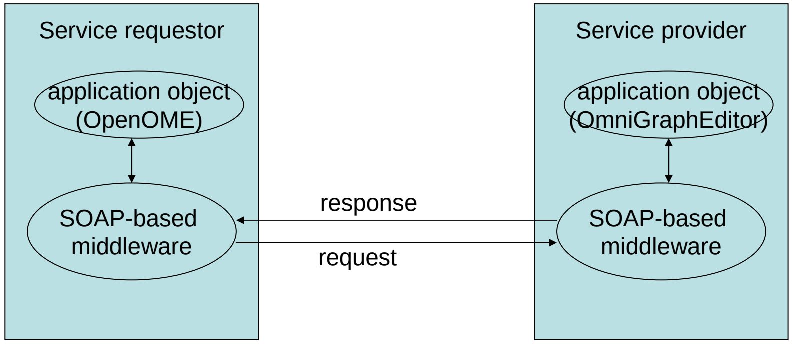
- Web Services Standards (XML-based)
  - SOAP (Simple Object Access Protocol)
  - WSDL (Web Service Description Language)
  - UDDI (Universal Description, Discovery, Integration)
  - WS-I (integration), WS-Policy, WS-Security, etc.
- Chances and Challenges
  - Application Wrappers to WS
  - Web Services Compositions
  - Holy Grail: large reusable library of WS with interoperability:
    1,000 public WS ~ 1 Million private WS
  - ROI (Return of Investments): > 10x ?
  - Issues: Privacy, Security, Performance

An example web service

xmethods provides a web services to get the stock price

- Example SOAP messages
- Structure of WSDL descriptions
- A program that invokes the web service

SOAP architecture



Example

SOAP message: request

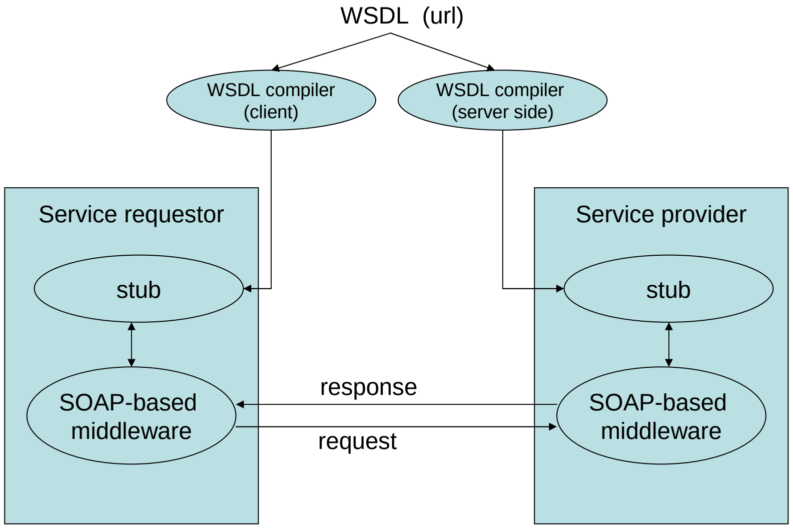
```
<?xml version="1.0" encoding="UTF-8"?>
<SOAP-ENV:Envelope
 xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
 xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 xmlns:ns="urn:xmethods-delayed-quotes">
 <SOAP-ENV:Body SOAP-
    ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
  <ns:getQuote>
   <symbol>IBM</symbol>
  </ns:getQuote>
 </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

Example

SOAP message: response

```
<?xml version="1.0" encoding="UTF-8"?>
<SOAP-ENV:Envelope
 xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
 xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 xmlns:ns="urn:xmethods-delayed-quotes">
 <SOAP-ENV:Body SOAP-
    ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
  <ns:getQuoteResponse>
   <Result>86.05</Result>
  </ns:getQuoteResponse>
 </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

WSDL architecture



Example

WSDL structure: message

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions name="quote“
  xmlns:tns="urn:xmethods-delayed-quotes"
  … name spaces …>
      … types …
      <message name="getQuoteRequest">
       <part name="symbol" type="xsd:string"/>
      </message>
      <message name="getQuoteResponse">
       <part name="Result" type="xsd:float"/>
      </message>
      … portType, binding, service …
</definitions>
```

Example

WSDL structure: portType

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions name="quote"
  … name spaces …>
      … types, messages, …
      <portType name="quotePortType">
        <operation name="getQuote">
          <input message="tns:getQuoteRequest"/>
          <output message="tns:getQuoteResponse"/>
        </operation>
      </portType>
      … binding, service …
</definitions>
```

Example

WSDL structure: binding

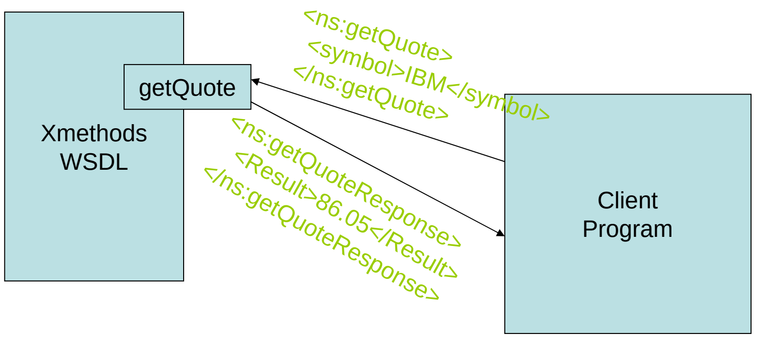
```
<?xml version="1.0" encoding="UTF-8"?>
<definitions name="quote"
  … name spaces …>
     … types, messages, portType …
      <binding name="quote" type="tns:quotePortType">
       <SOAP:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http"/>
       <operation name="getQuote">
        <SOAP:operation soapAction=""/>
        <input>
         <SOAP:body use="encoded" namespace="urn:xmethods-delayed-quotes"
           encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
        </input>
        <output>
         <SOAP:body use="encoded" namespace="urn:xmethods-delayed-quotes"
           encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
        </output>
       </operation>
      </binding>
      … service …
</definitions>
```

Example

WSDL structure: service

```
<?xml version="1.0" encoding="UTF-8"?>
<definitions name="quote"
  … name spaces …>
      … types, messages, portType, binding …
      <service name="quote">
          <port name="quote" binding="tns:quote">
           <SOAP:address location="http://services.xmethods.net/soap"/>
          </port>
      </service>
</definitions>
```

Web Services Invocation



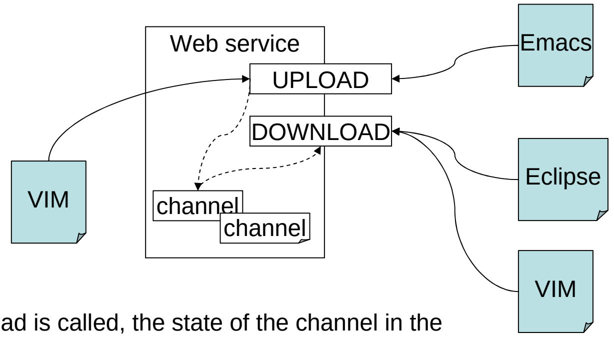
Invoking the web service

gsoap/soapcpp2/samples/quote

```
//gsoap ns service name:       quote
//gsoap ns service style:        rpc
//gsoap ns service encoding:   encoded
//gsoap ns service namespace: urn:xmethods-delayed-quotes
//gsoap ns service location:       http://services.xmethods.net/soap
int ns__getQuote(char *symbol, float *Result);  /* quote.h */
/* quote.c */
int main(int argc, char **argv)
{ struct soap soap;
  float q;
  char *sym;
  if (argc > 1)
    sym = argv[1];
  else
  { fprintf(stderr, "Usage: quote <ticker>\n");
    exit(1);
  }
  soap_init(&soap);
  if (soap_call_ns__getQuote(&soap, "http://services.xmethods.net/soap", "", sym, &q) == 0)
     printf("\nCompany - %s    Quote - %f\n", sym, q);
  else
    soap_print_fault(&soap, stderr);
  soap_end(&soap);
  soap_done(&soap);
  return 0;
}
```

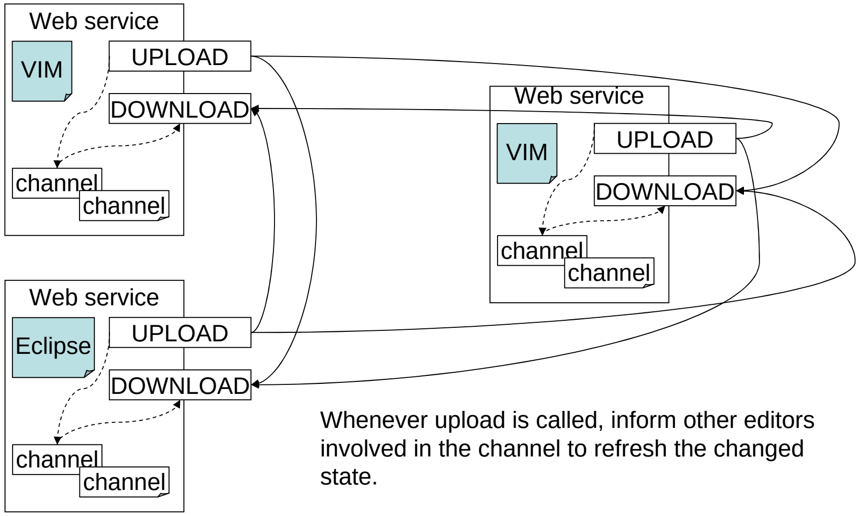
```
%> quote IBM
Company - IBM    Quote - 86.269997
%>
```

Reference Architecture 1: Client/Server



Whenever upload is called, the state of the channel in the server is updated or a new channel is created, and only when the editors need to refresh the buffer, they pull the information (downloading). Make sure the difference between downloaded buffer and the current buffer can be displayed.

Reference Architecture 2 Peer-to-Peer



Whenever upload is called, inform other editors involved in the channel to refresh the changed state.

The OmniEditor Web Service

- Tools you need: Axis-1_1, Jakarta Tomcat server

/u/prof/yijun/software/axis-1_1
/u/prof/yijun/software/jakarta-tomcat-5.0.28

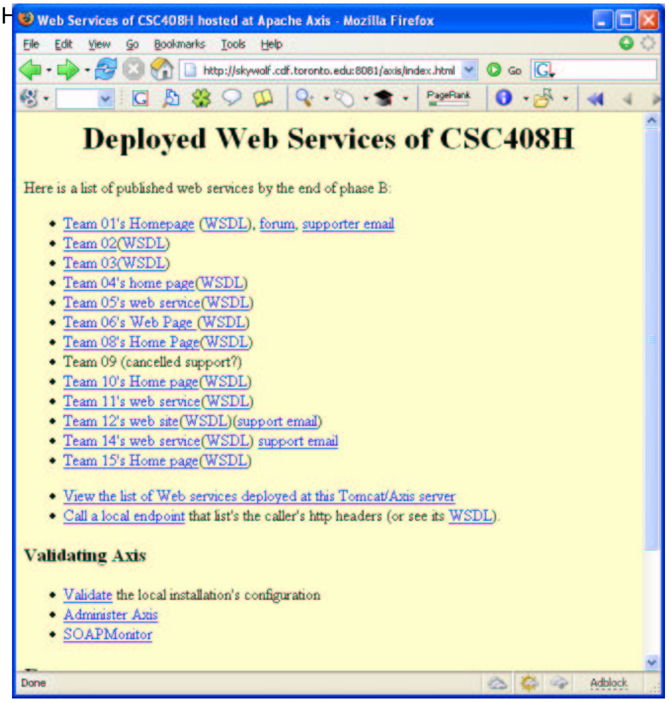
- A few implementations of the OmniEditor

http://skywolf.cdf.toronto.edu:8081/axis

- We put them in the ECF

/u/prof/yijun/axis
/u/prof/yijun/deployed

- Phase A. You need to study one of them to understand how it works.
- Phase B. You can develop your own, or modify the existing ones to a number of operations for the graph editor
- Phase C. You need to study invoke the web service in your graph editor.


Web Services of CSC408H hosted at Apache Axis - Mozilla Firefox
File
Edit
View
Go
Bookmarks
Tools
Help
http://skywolf.cdf.toronto.edu:8081/axis/index.html
Go
PageRank
Done
Adblock

Deployed Web Services of CSC408H

Here is a list of published web services by the end of phase B:

- Team 01's Homepage (WSDL), forum, supporter email
- Team 02(WSDL)
- Team 03(WSDL)
- Team 04's home page(WSDL)
- Team 05's web service(WSDL)
- Team 06's Web Page (WSDL)
- Team 08's Home Page(WSDL)
- Team 09 (cancelled support?)
- Team 10's Home page(WSDL)
- Team 11's web service(WSDL)
- Team 12's web site(WSDL)(support email)
- Team 14's web service(WSDL) support email
- Team 15's Home page(WSDL)

- View the list of Web services deployed at this Tomcat/Axis server
- Call a local endpoint that list's the caller's http headers (or see its WSDL).

Validating Axis

- Validate the local installation's configuration
- Administer Axis
- SOAPMonitor

An example requirements specification

```
float getQuote(String name);
  // precondition: name = ticker symbol
  // postcondition: return -1 if name does not exist
float getQuote(String name);
  // precondition: name = part of the full name
  // postcondition: return -1 if name doesn’t exist,
  //                       -2 if multiple matches
```

What are the Goal (purpose), Input, Output, Pre/post-conditions and Exceptions?

Required functions for the OmniGraphEditor Web Services

- Upload
- Download
- Insert
- Delete
- Select (highlight)

For each function, you may have several alternatives. You shall make decision based on non-functional requirements (quality attributes)