Application Servers
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Session 11 - Main Theme
Service Oriented Architecture
Web Services Platforms (Part II)

Dr. Jean-Claude Franchitti

New York University
Computer Science Department
Courant Institute of Mathematical Sciences

Agenda

- Continued from Session 10:
  - EAI and B2Bi Environments
  - MDA Technology
  - XML-Based Secure Messaging
  - Web Services
  - Mainstream UDDI Registries and Browsers
  - Mainstream Services Toolkits
  - Summary
  - Readings
Summary of Previous Session

- Continued from Session 8-9-10:
  - Middleware and Component Infrastructures
  - EAI and B2Bi Environments
- MDA/BPM Technology
  - UML-Based Component Modeling and Related Standards
  - XML Pattern Languages and XML Model-Based Applications
- Web Services
  - XML-RPC
  - SOAP, DIME, and ROPE
  - UDDI, DISCO
  - WSDL
- Summary
- Readings

Application Servers Architectures

- Application Servers for Enhanced HTML (traditional)
  - a.k.a., Page-Based Application Servers
  - Mostly Used to Support Standalone Web Applications
- New Generation Page-Based Script-Oriented App. Servers
  - First Generation Extensions (e.g., Microsoft IIS with COM+/ASP)
  - Servlet/JSP Environments
  - XSP Environment
  - Can now be used as front-end to enterprise applications
  - Hybrid development environments
- Distributed Object Computing Platforms
  - Provide an infrastructure for distributed communications enabling
  - Still need to merge traditional web-oriented computing with object computing
- Object Management Architectures
  - DOC Platform + APIs to reusable services and facilities
- OMA + Component Models -> J2EE, CCM, DNA
- MDAs with XML/Web Services/Channels/BPM-Enabling services
Part I
(continued from Session 8-9-10)

**EAI and B2Bi**
*Enterprise Application Integration and Business to Business Integration*

*Also See Session 11 Presentations:*
“Enterprise Application Integration (EAI)”
“Practical Application of EAI”
“The STP and T+1 Application”

*and the Session 11 Handout on:*
“Enterprise Application Integration (EAI)”

Part II
(continued from Session 10)

**MDA Technology**

*Also See [http://www.omg.org/mda](http://www.omg.org/mda), and associated Webcast and* 
*Session 9 handout on “Application Modeling Using XML”*
Part III
(continued from Session 10)


Also See Session 9 Handout on:
“Secure Message Exchange on the Internet”

Part IV

Web Services Technology

Also See:
http://www.theserverside.com/resources/article.jsp?l=WebServices
Generic Web Services Runtime Architecture

Platform Elements

- SOAP: Remote Invocation (XML-RPC, XMLP, ebXML)
- UDDI: Trading and Directory Service
- WSDL: Expression of Service Characteristics
- XLANG/XAML: Transactional Support
- XKMS: Key Management (Authentication and Registration)
- ADS: Advertisement and Discovery of Services
- XFS: SOAP-based file system
- etc.
UDDI Sample
dynamically find other services

- Query
  ```xml
  <find_business generic="1.0" xmlns="urn:uddi-org:api">
    <name>Microsoft</name>
  </find_business>
  ```

- Reply
  ```xml
  <businessList generic="1.0" operator="Microsoft Corporation" truncated="false"
  xmlns="urn:uddi-org:api">
    <businessInfos>
      <businessInfo businessKey="0076B468-EB27-42E5-AC09-9955CF462A3">
        <name>Microsoft Corporation</name>
        <description xml:lang="en">Empowering people through great software</description>
        <serviceInfos>
          <serviceInfo businessKey="0076B468-EB27-42E5-AC09-9955CF462A3" serviceKey="1FFE1F71-2AF3-45FB-B788-09AF70F151A4">
            <name>Web services for smart searching</name>
          </serviceInfo>
        </serviceInfos>
      </businessInfo>
    </businessInfos>
  </businessList>
  ```

WSDL
Description and Binding Template

- Types -- a container for data type definitions using some type system (such as XSD).
- Message -- an abstract, typed definition of the data being communicated.
- Operation -- an abstract description of an action supported by the service.
- Port Type -- an abstract set of operations supported by one or more endpoints.
- Binding -- a concrete protocol and data format specification for a particular port type.
- Port -- a single endpoint defined as a combination of a binding and a network address.
- Service -- a collection of related endpoints.
WSDL Sample Definitions
what a web service does, where it resides, how to invoke it

- Service Advertisement - Types

```xml
<?xml version="1.0"?>
<definitions name="StockQuote"
  targetNamespace="http://example.com/stockquote.wsdl"
  xmlns:tns="http://example.com/stockquote.wsdl"
  xmlns:xsd1="http://example.com/stockquote.xsd"
  xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
  xmlns="http://schemas.xmlsoap.org/wsdl/>
<types>
  <schema targetNamespace="http://example.com/stockquote.xsd"
    xmlns="http://www.w3.org/1999/XMLSchema">
    <element name="TradePriceRequest">
      <complexType>
        <all>
          <element name="tickerSymbol" type="string"/>
        </all>
      </complexType>
    </element>
    <element name="TradePrice">
      <complexType>
        <all>
          <element name="price" type="float"/>
        </all>
      </complexType>
    </element>
  </schema>
</types>
```

- Service Advertisement - Messages and Ports

```xml
<message name="GetLastTradePriceInput">
  <part name="body" element="xsd1:TradePriceRequest"/>
</message>

<message name="GetLastTradePriceOutput">
  <part name="body" element="xsd1:TradePrice"/>
</message>

<portType name="StockQuotePortType">
  <operation name="GetLastTradePrice">
    <input message="tns:GetLastTradePriceInput"/>
    <output message="tns:GetLastTradePriceOutput"/>
  </operation>
</portType>
```
WSDL Sample Definitions
(continued)

- Service Advertisement - Bindings & Services

```xml
(binding name="StockQuoteSoapBinding"
  type="tns:StockQuotePortType">
  <soap:binding style="document"
    transport="http://schemas.xmlsoap.org/soap/http"/>
  <operation name="GetLastTradePrice">
    <soap:operation
      soapAction="http://example.com/GetLastTradePrice"/>
    <input>
      <soap:body use="literal"
        namespace="http://example.com/stockquote.xsd"
        encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
    </input>
    <output>
      <soap:body use="literal"
        namespace="http://example.com/stockquote.xsd"
        encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"/>
    </output>
  </operation>
</binding>
<service name="StockQuoteService">
  <documentation>My first service</documentation>
  <port name="StockQuotePort" binding="tns:StockQuoteBinding">
    <soap:address location="http://example.com/stockquote"/>
  </port>
</service>
```

WSDL Sample Definitions
(continued)

- Service Advertisement - Bindings & Services

```xml
(binding name="StockQuoteServiceBinding"
  type="StockQuoteServiceType">
  <soap:binding style="rpc"
    transport="http://schemas.xmlsoap.org/soap/http"/>
  <operation name="getQuote">
    <soap:operation
      soapAction="http://www.getquote.com/GetQuote"/>
    <input>
      <soap:body type="InMessageRequest"
        namespace="urn:live-stock-quotes"
        encoding="http://schemas.xmlsoap.org/soap/encoding/"/>
    </input>
    <output>
      <soap:body type="OutMessageResponse"
        encoding="http://schemas.xmlsoap.org/soap/encoding/"/>
    </output>
  </operation>
</binding>
<service name="StockQuoteService">
  <documentation>My first service</documentation>
  <port name="StockQuotePort" binding="tns:StockQuoteBinding">
    <soap:address location="http://example.com/stockquote"/>
  </port>
</service>
```

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WSDL Sample Definitions (continued)

- Service Advertisement - Bindings & Services

```xml
<binding name="StockQuoteServiceBinding"
type="StockQuoteServiceType">
  <soap:binding style="rpc"
    transport="http://schemas.xmlsoap.org/soap/http/>
  <operation name="getQuote">
    <soap:operation
      soapAction="http://www.getquote.com/GetQuote"/>
    <input>
      <soap:body
        type="InMessageRequest"
        namespace="urn:live-stock-quotes"
        encoding="http://schemas.xmlsoap.org/soap/encoding/"/>
    </input>
    <output>
      <soap:body
        type="OutMessageResponse"
        encoding="http://schemas.xmlsoap.org/soap/encoding/"/>
    </output>
  </operation>
</binding>

<service name="StockQuoteService">
  <documentation>My first service</documentation>
  <port name="StockQuotePort"
    binding="tns:StockQuoteBinding">
    <soap:address location="http://example.com/stockquote"/>
  </port>
</service>
</definitions>
```

Request to the StockQuote Service

- Soap Envelope:

```xml
POST /StockQuote HTTP/1.1
Host: www.stockquoteserver.com
Content-Type: text/xml;
charset="utf-8"
Content-Length: nnnn
SOAPAction: "Some-URI"

<SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
  <SOAP-ENV:Body>
    <m:GetLastTradePrice
      xmlns:m="Some-URI">
      <symbol>MOT</symbol>
    </m:GetLastTradePrice>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```
Response from the StockQuote Service

- Soap Envelope:

  HTTP/1.1 200 OK
  Content-Type: text/xml; charset="utf-8"
  Content-Length: nnnn

  <SOAP-ENV:Envelope
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/"
  SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/"
  <SOAP-ENV:Body>
  <m:GetLastTradePriceResponse
  xmlns:m="Some-URI">
  <Price>14.5c</Price>
  </m:GetLastTradePriceResponse>
  </SOAP-ENV:Body>
  </SOAP-ENV:Envelope>

XML-Based e-Services Protocols and Vendor Architectures

- HP’s NetAction/e-speak platform
- IBM WebSphere Architecture (WSA) platform
- Microsoft .NET platform
- Sun’s Open Net Environment (ONE)
- Oracle’s Dynamic Services platform
- BEA, etc.
Part V

**Conclusion**

Summary

- See http://www.xmethods.com/ for a list of publicly available web services and their SOAP access interfaces
- Various mainstream Web Services Toolkits have resulted from the initial HP proposal on e-speak
- Mainstream platforms include HP NetAction/e-speak, IBM WSA, Microsoft .Net, Sun ONE, Oracle Dynamic Services, and BEA offerings
Readings

- Readings
  - Building J2EE Applications with IBM WebSphere
    - Chapters on Web Services
  - Microsoft .NET Distributed Applications: Building Application Servers
    - Chapters on Web Services
  - Handouts posted on the course web site
  - Explore EAI/B2Bi/BPM, MDA, and Web Services Environments (IBM WSTK, Microsoft .Net, etc.)
  - Read related white papers/documentation on EAI/B2Bi/BPM, MDA, and Web Services environments

Project Frameworks

- Project Frameworks Setup (ongoing)
  - Apache Web Server (version 1.3.28/2.2.3+, www.apache.org)
  - Perl (version 5.9.4+, www.perl.com)
  - Microsoft IIS with COM+/Net and ASP
  - Apache Tomcat
  - (Macromedia JRun4)
  - Apache Cocoon 2/XSP
  - Visibroker, Orbacus
  - RMI-IIOP
  - WebLogic, WebSphere, JBoss
  - OpenCCM, ExoLab.org OpenCCM
  - Apache’s XercesJ, XalanJ, XMLSpy, Antenna House XML Formatter, Apache’s FOP, X-smiles
  - JWS, XMI Toolkit, IBM’s Web Service Toolkit
  - POSE, KVM for J2ME, NanoXML
  - IBM (Alphaworks) WSTK, WebMethods, etc.
Assignment

- Explore the references to Web Services-Enabled Application Server technology
- Homework #1-4 final due date is 12/07/09
- Revised Project Proposal: due on the project demo date
  - Project Demo time slots will be posted shortly
- Final Project Demo: online or in person (details will follow)

Next Session:
Upcoming Application Server Technologies

- Model Driven Architectures
- Reflective Application Servers
- Intelligent Agents
- Multimedia/Broadband Application Servers