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Web Services 201

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Chuck Arney
 illustro Systems International LLC
 carney@illustro.com




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Agenda

- What is a Web Service and who defines the specifications
- Technologies that are used by Web Services
- Live demonstrations
 - Creating a Web Service
 - Consuming a Web Service
- Other considerations
- Web Service Resources




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Definitions of a Web Service


- A Web service is a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP-messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.

W3C

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Definitions of a Web Service

- Some kind of function you can use across some kind of network
 - Usually involve short interactions (connect, access code, disconnect)
 - Discoverable, maybe ...
 - Described with XML
- A Web Service is the exposure of a business process over a network

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Who Defines Web Services?

- Open System Standards Organizations
 - World Wide Web Consortium (W3C)
www.w3c.org
 - Web Services Interoperability Organization (WS-I)
www.ws-i.org

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Who Defines Web Services?

- Software Vendors
 - IBM Corp.
www.ibm.com/developerworks/webservices
 - Microsoft Corp.
www.microsoft.com/webservices
 - Hewlett-Packard Company
devresource.hp.com/drc/topics/web_services.jsp

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Components of a Web Service

- Service Provider
 - Delivers services across the network
 - Publishes their services to a broker
- Service Requestor
 - Asks the broker for a service
 - Binds to the provider once its found
- Service Broker
 - Matchmaker between providers and requestors

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Operations of a Web Service

- Publish
 - Service providers advertise (or not) their services with a service broker
- Find
 - Service requestors ask the broker for a service that meets certain criteria
- Bind
 - Service requestor bind to the service provider and transaction ensue

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Behind the Technology

- XML
 - EVERYTHING is in XML
- SOAP
 - Simple Object Access Protocol
 - Protocol to make requests and receive result
- WSDL
 - Web Service Description Language
 - Describes the available services, inputs and outputs


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Behind the Technology


- UDDI
 - Universal Description, Discovery and Integration
 - Data base of available services (gets you to the WSDL)
 - API to search and update the data base


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Data Transports


- Web Service protocols do not define the physical (wire) or logical (application layer) protocol used to transmit requests and results
- Typically the TCP/IP protocols used are
 - SMTP
 - HTTP



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Data Transports


- Simple Mail Transfer Protocol (SMTP)
 - Early TCP/IP protocol
 - Multipurpose Internet Mail Extensions (MIME) support allows non-textual data
- Problems with SMTP
 - Non-textual data must be encrypted
 - Security problems
 - Data size limitations



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Data Transports


- Hypertext Transfer Protocol (HTTP)
 - Most used protocol for Web Services
 - Newer protocol (1990s)
 - Supports binary data
 - Request headers more extensible
 - Request/response model
- Other protocols are possible
 - Internet Inter-ORB Protocol (IIOP)
 - IBM MQSeries


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eXtensible Markup Language XML

- Platform independent way to share data
- Markup language similar to SGML
- Tags describe the meaning and purpose of the data
- Data only, no presentation attributes
- Used for all documents, requests and responses in Web Services architecture
- Details at www.w3c.org


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SOAP Design

- Vendor neutral
- Language neutral
- Platform neutral
- Transport neutral


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SOAP Server

- Usually a Web Service lives behind a SOAP Server or Web Server that understands SOAP requests
 - Handles the transport protocol (HTTP)
 - Processes the SOAP request document
 - Calls processing program passing input data
 - Creates and returns result message


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SOAP Messages

- There are request and response messages
 - A request invokes a method on a remote object
 - A response returns the result of running the method
- Requests can use either Remote Procedure Call or Document style messages


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SOAP Messages

- Most Web Services use RPC style messages
 - SOAP specification defines how calls and returns are serialized in messages
- Document style messages can transport any XML document as long as the SOAP Server knows what to do with it



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SOAP Envelopes

- A SOAP envelope contains the message itself
- The message is in an application specific vocabulary; namespaces distinguish the parts
- The envelope can contain a header, and MUST contain a body



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SOAP Request

- **<SOAP-ENV:Envelope
xmlns:SOAP-ENV="..."
SOAP-ENV:encodingStyle="...">
<SOAP-ENV:Body>
 <m:getLastTradePrice
 xmlns:m="my-ns">
 <symbol>IBM</symbol>
 </m:getLastTradePrice>
 </SOAP-ENV:Body>
</SOAP-ENV:Envelope>**



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SOAP Response

```

■ <SOAP-ENV:Envelope
  xmlns:SOAP-ENV="..."
  SOAP-ENV:encodingStyle="...">
  <SOAP-ENV:Body>
    <m:getLastTradePriceResponse
      xmlns:m="my-ns">
      <price>91.77</price>
    </m:getLastTradePriceResponse>
  </SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```



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Live Demo



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Web Services Description Language

- If we're going to find and use web services automatically, we have to have a way to describe them
 - WSDL is used to describe a web service when it is published
 - When a service is located, WSDL is used to invoke it



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Web Services Description Language

- The WSDL file contains everything needed to make a SOAP request
 - The address of the machine that hosts the service
 - The name of the service
 - The name of the method
 - The name and types of the arguments to the method



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SOAP and WSDL

- To make a SOAP request we have to know the arguments
- Start out looking in the WSDL


```
<portType>
<portType name="GreetingWSSOAP">
  <operation name="GetGreeting">
    <input
      message="s0:GetGreetingSOAPIn" />
  </operation>
</portType>
```
- This says use **GetGreetingSOAPIn** message as the input to the method



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SOAP and WSDL

- Now look at the **GetGreetingSOAPIn** message


```
<message name="GetGreetingSOAPIn">
  <part name="parameters"
    element="GetGreeting" />
</message>
```
- This message references the **GetGreeting** data type defined earlier



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SOAP and WSDL

- Now look at the **GetGreeting** data type to see what goes in the method call

```
<s:element name="GetGreeting">
  <s:complexType>
    <s:element minOccurs="1"
      maxOccurs="1"
      name="greetingNumber"
      type="s:int" />
    </s:complexType>
  </s:element>
```



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SOAP and WSDL

- In reality, we will write our client code to a known programming interface
 - We will know the method name and number and type of arguments ahead of time
- But, this information in the WSDL will be used by our tools to automatically generate proxy classes for us



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Universal Description, Discovery and Integration

- Web Service discovery
- Defines standards for distributed registry of Web Services
 - White pages company information
 - Yellow pages categories of services
 - Green pages business rules



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UDDI Registries


- IBM, Microsoft, SAP, NTT and others provide registries of Web Services
 - See www.uddi.org/find.html for access
- See www.ibm.com/services/uddi for information on IBM's registry
- You can register for no charge and publish your own Web Services



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UDDI Registries


- Registration basic process
 - Split your WSDL file
 - Register the interface portion as a TModel
 - Describe your business with a BusinessEntity
 - Add a BusinessServices record to describe your service. Refers to BusinessEntity and TModel
 - Install the WSDL file on your web server



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UDDI Process


- The UDDI discovery process
 - Client queries the UDDI registry for a service and receives the result
 - Client uses the results to request the WSDL file from the service provider's web server
 - Client invokes the service using the information from the WSDL file and receives the result from the service


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UDDI4J

- IBM has released UDDI4J, a free, open source implementation of the client side of UDDI.
 - Simplifies the task of interacting with a UDDI registry
 - JAVA Class Library
 - See www-124.ibm.com/developerworks/projects/uddi4j


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Recommendations


- When starting to use Web Services
 - Start with a pilot project to prove the value up front
 - Start small, grow fast
 - Do something representative of your larger goal
 - Goals can be achieved by a small team in 2-3 months
 - Define goals, expectations and measures of success before starting


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Other Considerations

- Web Services is not the only method to achieve the result
 - Pluses
 - Open standards
 - Easy to use with supporting tools
 - Impressive technology
 - Minuses
 - More technologies to master
 - Serialization of passed values is overhead
 - Maybe more difficult to debug when there are problems


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Other Considerations

- J2EE and .NET support direct XML handling
 - XML parser APIs (DOM and SAX)
 - Stream readers and writers (XMLStreamReader/XMLStreamWriter)
- They also support sockets and even HTTP
- XML documents can be sent/received and processed without SOAP overhead



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Resources

- World Wide Web Consortium
 - WWW.W3C.org
- Web Services Interoperability Organization
 - WWW.WS-I.org
- OASIS
 - www.oasis-open.org
 - www.uddi.org



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Resources

- IBM developerWorks
 - Ibm.com/developerworks/webservices
 - Ibm.com/developerworks/speakers/dtidwell
 - Ibm.com/developerworks/speakers/colan
- IBM Redbooks
 - redbooks.ibm.com
- IBM alphaWorks (WSTK)
 - www.alphaworks.Ibm.com/webservices



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Resources

- Apache Web Services Project
 - ws.apache.org
- LOTS of books are available
 - Professional XML Web Services
Wrox Press, ISBN 1-861005-09-1
 - Developing .NET Web Services with XML
Syngress Publishing, ISBN 1-928994-81-4



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