



**DESCRIPTOR SYSTEMS**

"We Bring You Up To Speed"

## Programming Web Services in Java

- Description** This course teaches students how to program Web Services in Java, including using SOAP, WSDL and UDDI.
- Audience** Developers and other people interested in learning how to create and consume Web services.
- Prerequisites** You should have prior Java programming experience and experience working with XML.
- Length** 5 days
- Format** Instructor-led; lecture and hands-on lab exercises
- Objectives:** After taking this course, you will be able to:
- Understand the benefits of service-oriented architectures and Web services
  - Understand the structure of SOAP messages and the SOAP processing model
  - Use the JAX-RPC API to create Web services and Web service clients
  - Use the SAAJ API to work with document-oriented Web services
  - Write JAX-RPC message handlers
  - Understand the structure and use of WSDL
  - Understand the structure and use of UDDI
  - Understand the issues involved with Web service interoperability

### ***Topic Outline:***

- Introduction to Web Services
- XML Review
- SOAP Fundamentals
- Introduction to JAX-RPC
- WSDL Fundamentals
- Developing a JAX-RPC Service
- Writing a JAX-RPC Client
- Document Oriented SOAP
- EJBs for Web Services
- Web Services for J2EE
- UDDI Fundamentals
- Web Services Security

## ***Detailed Topic List***

### 1. Introduction to the Course

- Java Web Services Programming
- Legal Information
- Java Web Services Programming
- Introductions
- Course Description
- Course Objectives
- Sample Agenda
- Sample Agenda, cont'd
- Sample Agenda, cont'd
- Sample Agenda, cont'd
- Sample Agenda, cont'd

### 2. Introduction to Web Services

- Introduction to Web Services
- What are Web Services?
- Benefits of Web Services
- Web Services Challenges
- Service Oriented Architectures
- What is SOAP?
- Example SOAP Message
- Example RPC Response
- What is WSDL?
- Example WSDL
- Example WSDL, cont'd
- Example WSDL, cont'd
- What is UDDI?
- Using UDDI
- Java APIs for Web Services
- Toolkits for Web Services
- Chapter Summary

### 3. XML Overview

- XML Overview
- What is XML?
- Why Use XML?
- Basic XML Syntax Rules
- Sample XML Content
- More Sample XML Content
- Name Ambiguity
- One Solution
- Introduction to XML Namespaces
- Namespace Syntax
- Content with Multiple Namespaces
- Defining a Default Namespace
- Well Formed Versus Valid
- Introducing XML Schema
- A Sample Schema
- Simple Types vs Complex Types
- Sample Built-in Simple Types
- Defining a New Simple Type
- Defining Complex Types
- Compositors

- Defining Elements
  - Element Occurrence Constraints
  - Defining Attributes
  - Attribute Occurrence
  - Referencing Global Elements
  - Writing an XML Application
  - SAX vs DOM
  - Introduction to DOM
  - DOM Interfaces
  - Sample XML Content
  - Objects in the DOM Tree for Sample
  - Steps for Using DOM
  - DOM Sample Program
  - DOM Sample Program. cont'd
  - Introduction to SAX
  - SAX Interfaces and Classes
  - Steps for Using SAX
  - SAX Sample Program
  - SAX Sample Program, cont'd
  - SAX Sample Program, cont'd
  - SAX Sample Program, cont'd
  - Chapter Summary
4. SOAP Fundamentals
- SOAP Fundamentals
  - What is SOAP?
  - History of SOAP
  - SOAP and the W3C
  - SOAP 1.1 vs SOAP 1.2
  - Structure of a SOAP Message
  - SOAP Messages and Namespaces
  - SOAP Message Exchange
  - Introduction to SOAP RPC
  - SOAP RPC Fundamentals
  - SOAP RPC Fundamentals, cont'd
  - Sample SOAP 1.1 RPC Request
  - Sample SOAP 1.1 RPC Response
  - Sample SOAP 1.2 RPC Request
  - Sample SOAP 1.2 RPC Response
  - Introduction to SOAP RPC Encoding
  - Encoding Issues
  - Encoded RPC Request
  - Literal RPC Request
  - SOAP and Complex Types
  - Object Graphs
  - Encoded Object Graphs
  - Intro to SOAP Document Exchange
  - Sample SOAP 1.2 Document Exchange
  - SOAP Attachments
  - Introduction to SOAP Protocol Binding
  - Sample SOAP 1.1 HTTP Request
  - Sample SOAP 1.1. HTTP Response
  - Sample SOAP 1.2 HTTP Request
  - Sample SOAP 1.2 HTTP Response
  - SOAP Faults
  - Example SOAP 1.1 Fault

- Example SOAP 1.2 Fault
  - SOAP Message Path
  - SOAP Intermediaries and Headers
  - The actor Attribute
  - The mustUnderstand Attribute
  - Processing Headers
  - Chapter Summary
5. WSDL Fundamentals
- WSDL Fundamentals
  - What is an IDL?
  - What is WSDL?
  - WSDL and SOA
  - History of WSDL
  - Creating WSDL
  - Using WSDL
  - Structure of a WSDL Document
  - Structure of a WSDL Document, cont'd
  - Abstract versus Concrete WSDL
  - The Definitions Element
  - The Types Section
  - The Messages Section
  - The PortType Section
  - The Bindings Section
  - The Bindings Section, cont'd
  - The Bindings Section, cont'd
  - The Service Section
  - Factoring WSDL
  - Using WSDL with UDDI
  - WS-Policy Overview
  - Chapter Summary
6. Introduction to JAX-RPC
- Introduction to JAX-RPC
  - XML RPC vs XML Messaging
  - What is JAX-RPC?
  - JAX-RPC Implementations
  - Why Remote Procedure Calls?
  - History of RPC
  - JAX-RPC and SOAP
  - JAX-RPC Architecture
  - What is a Stub?
  - Related Specifications
  - Chapter Summary
7. Developing a JAX-RPC Service
- Developing a JAX-RPC Service
  - JAX-RPC Fundamentals
  - Service Programming Model
  - The Service Endpoint Interface
  - The Service Endpoint Class
  - The Service Endpoint Class Lifecycle
  - The ServletEndpointContext
  - The MessageContext
  - Implementing ServiceLifeCycle
  - Mapping to/from XML

- Supported Java Primitives
- Supported Standard Java Types
- Arrays
- Value Types
- Value Type Example
- Quiz
- Object Graphs
- Input, Output and Input/Output Parameters
- Parameters, cont'd
- Parameters, cont'd
- Parameters, cont'd
- SOAP Faults
- SOAP Faults, cont'd
- SOAP Faults, cont'd
- Attachments
- Chapter Summary

## 8. Writing a JAX-RPC Client

- Writing a JAX-RPC Client
- Types of JAX-RPC Clients
- Static Stubs
- JAX-RPC Stub API
- Standard Stub Properties
- Retrieving a Static Stub Reference
- Portable Static Stub References
- Calling SEI Methods on the Stub
- Static Stub Example: IBM Specific
- Static Stub Example: Portable
- Setting Properties
- Dynamic Stubs
- Dynamic Proxy Example
- Dynamic Proxy Example, cont'd
- Dynamic Proxy Example, cont'd
- The Dynamic Invocation Interface
- The DII API
- The DII API, cont'd
- DII Example
- DII Example, cont'd
- DII Example, cont'd
- Chapter Summary

## 9. Document Oriented SOAP

- Document-Oriented SOAP
- Document-Oriented versus RPC
- Document-Oriented Java APIs
- Data Binding versus Raw XML
- The SAAJ API
- The SAAJ API, cont'd
- SAAJ SOAPElement
- SAAJ Example: Building a Message
- SAAJ Example: Sending a Message
- SAAJ Example: Receiving a Message
- Using DOM
- Introduction to JAX-B
- Introduction to Apache XMLBeans
- Design By Contract

- Non-XML Content
- SOAP with Attachments
- Creating an Attachment
- SOAP Message with Attachment
- Processing the Attachment
- Chapter Summary

#### 10. Introduction to JAXB

- Introduction to JAXB
- Marshaling XML to/from Java
- What is Data Binding?
- Java XML Strategies
- Introduction to JAXB
- JAXB Development Steps
- The JAXB Binding Compiler
- Sample Schema
- Sample Schema, cont'd
- Running the Binding Compiler
- Examining a Generated Class
- Examining a Generated Class, cont'd
- Unmarshaling: An Example
- Unmarshaling: An Example, cont'd
- Unmarshaling: An Example, cont'd
- Unmarshaling: An Example, cont'd
- Unmarshaling with Validation
- Marshaling XML
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#### 11. JAX-RPC Message Handlers

- JAX-RPC Message Handlers
- JAX-RPC Handlers
- Client-Side Handlers
- Client-Side Handler Flow
- Server-Side Handlers
- Server-Side Handler Flow
- Fault Handlers
- Request Handler Actions
- Response Handler Actions
- Fault Handler Actions
- Writing a Handler
- A Simple Server-Side Handler, cont'd
- A Simple Server-Side Handler, cont'd
- A Simple Server-Side Handler, cont'd
- Configuring Server-Side Handlers
- Configuring Client-Side Handlers
- Configuring Client-Side Handlers, cont'd
- The MessageContext Object
- Using the MessageContext Object
- SOAP Headers
- SOAP Message with Header
- Configuring Headers for Handlers: WSDL
- Configuring Headers for Handlers: DD
- SAAJ Types for Header Processing
- Header Processing Example: Client
- Example: Client, cont'd
- Example: Client, cont'd

- Header Processing Example: Service
- Example: Service, cont'd
- Example: Service, cont'd
- Chapter Summary

## 12. EJBs for Web Services

- EJB for Web Services
- What is a JavaBean?
- The EJB Architecture
- The EJB Architecture: The Big Picture
- Using EJBs for Web Services
- What is a Container?
- Container Vendors and Implementations
- EJB Types
- Remote Interfaces
- The EJB Object and Bean Implementation
- The Home
- Development Steps for a Hello World EJB
- Hello World Remote Interface
- Hello World Home Interface
- Hello World Bean Implementation
- Hello World Bean Implementation, cont'd
- Hello World Bean Implementation, cont'd
- Hello World Deployment Descriptor
- Creating the EJB JAR
- Creating the Enterprise Archive
- Deploying the Hello World EJB
- Chapter Summary

## 13. Web Services for J2EE

- Web Services for J2EE
- What is Web Services for J2EE?
- WSEE Highlights
- Servlet Endpoint Deployment Model
- Stateless Session EJB Deployment Model
- Server Deployment Descriptor: Servlet
- Server Deployment Descriptor: EJB
- Client Deployment Descriptor
- Managed Client Architecture
- The Environment Naming Context
- Example Managed Client
- Example Managed Client, cont'd
- Chapter Summary

## 14. UDDI Fundamentals

- UDDI Fundamentals
- What is UDDI?
- UDDI History
- UDDI and SOA
- Public and Private Registries
- The Universal Business Registry
- Invoking UDDI
- UDDI Taxonomies
- UDDI Information Model
- The BusinessEntity
- The BusinessService

- The BindingTemplate and tModel
- Integrating UDDI and WSDL
- Integrating UDDI and WSDL, cont'd
- UDDI Publishing API
- Sample UDDI Publishing Message
- UDDI Inquiry API
- Sample UDDI Inquiry Message
- Accessing UDDI From Java
- Writing Dynamic Service Requesters
- Chapter Summary

#### 15. Web Services Security

- Web Services Security
- Security Fundamentals
- Message Integrity
- Message Confidentiality
- Encryption Fundamentals
- PKI Fundamentals
- Using PKI for Confidentiality
- Using PKI for Authentication
- Message Digests
- Signed Message Digests
- Digital Certificates
- Web Service Security Issues
- XML Security Standards
- SOAP Message Signing and Encryption Issues
- WS-Security
- Canonical XML
- XML Signature
- Signed Message Body Example
- XML Encryption
- Encrypted Body Example
- Encrypted Body Example, cont'd
- Outstanding Issues
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#### 16. Web Services Interoperability

- Web Services Interoperability
- Web Services Interoperability
- Best Practices for Interoperability
- The WS-I Group
- WS-I Deliverables
- WS-I Profiles
- The Basic Profile
- Highlights of the Basic Profile
- Highlights of the Basic Profile, cont'd
- The Attachments Profile
- The Basic Security Profile
- Highlights of the Basic Security Profile
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#### 17. Introduction to JAX-WS

- Introduction to JAX-WS
- Introduction to JAX-WS
- JAX-WS Highlights
- More Highlights



- JAX-WS Clients
- Writing a Simple Service
- Deploying the Service
- Writing a Client for the Simple Service
- Chapter Summary

## 18. Introduction to REST

- Introduction to REST
- What is REST?
- REST vs SOAP
- Principles of REST
- Resource IDs
- Resources With Multiple Representations
- Use Links to Connect Resources
- Use Standard HTTP Methods
- Stateless Communication
- REST in Java
- What are Restlets?
- Restlet Framework Features
- A Simple Restlet
- The Restlet Application
- The Restlet on a Servlet Container
- JAX-WS and REST
- JAX-RS
- A JAX-RS Service
- Configuring a JAX-RS Web App
- Chapter Summary