

## TT7301 Core Web Services and SOA for J2EE Developers (4 days)



Geared for experienced developers, *Core Web Services and SOA for J2EE Developers* is a four day, lab-intensive course that provides an in-depth coverage of what J2EE developers need to know to design, implement, and deliver web services within the J2EE framework. In addition to introducing students to the fundamentals of Service Oriented Architectures (SOA) and the core standards that enable Web Services, it provides them hands-on experience with implementations of the Java XML and Web Service APIs including JAXP, JAXB, SAAJ, JAX-WS/RPC, WSEE, XWSS, and Apache Axis2.

SOA and Web Services represent a groundbreaking evolution in distributed computing. The concepts are not altogether new, but the application of them, and the unanimous acceptance of core standards like HTTP, XML, SOAP, WSDL, and UDDI, has paved the way for XML Web Services and service-oriented architecture.

### ► Course Objectives: What You'll Learn

Today's development environments are increasingly dominated by sophisticated tooling that makes the initial development of web services less arduous. The production-level implementation, deployment, and maintenance of web services are far more complex and demanding.

*Core Web Services and SOA for J2EE Developers* focuses on providing an understanding of the fundamental technologies used in web services. This understanding is critical to being able to diagnose, troubleshoot, tune, and perform other lifecycle activities.

Working in a dynamic, interactive discussion and hands-on programming environment, developers will be able to:

- Understand and apply the basic concepts of SOA to the identification and design of web services
- Understand and intelligently discuss Web Services and the core technologies involved
- Design, develop, and deploy real-world J2EE Web Services
- Expose existing Java components as XML Web Services
- Write Java components that access remote Web Services hosted by a third party
- Read and understand a WSDL document
- Understand the concepts behind REST and implement a REST-based web service
- Understand and work with Apache Axis2 and its enhanced capabilities
- Recognize security vulnerabilities associated with potential or actual web services and design/implement effective defenses for those services and related resources.

Prior to digging into the technical aspects of web services, students are given an introduction to Service-Oriented Architectures, providing a broad context for the purpose and goals for identifying and implementing web services.

**Duration:** 4 days  
**Skill Level:** Intermediate  
**Focus:** J2EE Web Services  
**Audience:** Experienced J2EE developers  
**Format:** Extensive hands-on programming labs, expert lecture combined with open discussions and high-Level demonstrations and dynamic group exercises.  
**Language / Tools:** Java/ XML, SOAP, REST, WSDL /Delivered with most IDEs, including Eclipse, MyEclipse, RAD, JDeveloper, etc. and many servers, including JBoss, WebSphere, WebLogic, etc.  
**Delivery Format:** Available for onsite private classroom presentation, or live online / virtual presentation  
**Customizable:** Yes

COURSE SNAPSHOT

Students will explore at the current state of the art of Web services, what works and what doesn't work, and also at newer standards, and how they fit into the Web services picture. Web services are still evolving rapidly, and this course will give you a thorough understanding of the current Web services architecture, and the technologies that support Web services including:

- **SOAP/SAAJ** – Simple Object Access Protocol - A remote invocation (RPC) and messaging mechanism.
- **WSDL** – Web services Description Language – An XML language that describes the interface and semantics of a Web service.
- **UDDI** – Universal Description, Discovery, and Integration – A standard for describing, publishing and finding Web services.
- **JAX-WS/RPC** – Accessing Web services using Java
- **REST**- Representational State Transfer - A style of implementing web services that is gaining increasing acceptance and use
- **Apache Axis2** - A state of the art web services engine that had a proven track record in supporting production level web services
- **WS-I** –Web Services Interoperability
- **WS-Security/XWSS** – Web Services Security

The course provides a solid foundation in basic terminology and concepts, extended and built upon throughout the engagement. Processes and best practices are discussed and illustrated through

both discussions and group activities.

Attending students will be led through a series of advanced topics comprised of integrated lectures, extensive hands-on lab exercises, group discussions and comprehensive demonstrations. Please see below for additional information about the hands-on lab work.

#### ► Audience & Pre-requisites: Who Should Attend

This is an **intermediate** level web services training course, designed for Java developers and architects who need to identify, design, and implement web services. We will explore and apply the terminology, the specification, the processes and technologies specific to web services.

Students should have 1-2 years of working knowledge with Servlets and JSPs, and should be familiar with XML, Namespaces, and XML Schema.

#### ► Related Courses – Suggested Learning Path

**Take Before:** Students should have basic understanding and working knowledge in the following topics, or attend these courses as a pre-requisite:

- **TT2100 Core Java Programming Fundamentals**
- **TT5100 Mastering J2EE Web Applications (Servlets, JSPs, JDBC, Security, etc.)**
- **TT4300 Core XML Fundamentals (XML, Schema, XPath, and XSLT)**

**Take Instead:** We offer other courses that provide different levels of knowledge or that blend web services development with other pertinent topics:

- If your team needs high level web services training, the **TT7005 Understanding Web Services** course may be more appropriate.
- For a shorter, subset web services course minus the SOA exposure, consider **TT7300 Core Web Services for J2EE Developers**
- For those members of your team that are focusing on using SOA with lighter web services, consider **TT7150 Mastering Service-Oriented Architectures (SOA) and J2EE Web Services**.
- If you need in-depth web services training but have minimal working knowledge with J2EE, consider: **TT7340 Integrating J2EE, SOA, and Web Services**.
- If you need in-depth web services training but have minimal working knowledge with XML, consider: **TT7360 Integrating XML, SOA, and J2EE Web Services**.

**Take After:** We offer a variety of introductory through advanced security, development, project management, engineering, architecture and design courses. Students may want to consider the following topics as a follow-on to this course.

- Additional web services topics – Intro through Advanced
- Additional advanced J2EE or Java EE topics
- Service-Oriented Architecture or SOA Analysis and Design

- Java or J2EE Security topics
- AJAX, XML or other Web Development topics
- Java EE topics: EJB3.0; Spring; Hibernate; Design Patterns & more.
- Architecture & Analysis courses

*Please note all development courses may also be offered in other programming languages or tailored to suit your unique requirements. Please contact us for recommended next steps tailored to your longer term education, project or development objectives.*

#### ► Experiential Learning: Hands-On Labs

This class is “technology-centric”, designed to train attendees in essential web services development skills, coupling the most current, effective techniques with the soundest industry practices.

This workshop is about **50% dynamic lab exercises** and **50% lecture**. Throughout the course students will be led through a series of progressively advanced topics, where each topic consists of lecture, group discussion, comprehensive hands-on lab exercises, and lab review. Multiple detailed lab exercises are laced throughout the course, designed to reinforce fundamental skills and concepts learned in the lessons. At the end of each lesson, developers will be tested with a set of review questions to ensure that he/she has fully understands that topic.

#### ► Student Materials: What You'll Receive

Our robust course materials include much more than a simple slideshow presentation handout. Trivera Technologies Student materials include a comprehensive hard-copy course manual, complete with detailed course notes, code samples, diagrams and current reference materials, all directly related to the course at hand, indexed for ease of use. Step-by-step lab instructions and project descriptions are clearly illustrated and commented for maximum learning and ease of use.

Our course kits are designed to serve as a useful reference set, long after we leave your classroom.

#### ► Delivery Environment & LoadNGo™ Classroom Set Up

Although this training is skills-centric, this course may run using a variety of IDEs and application server combinations, including but not limited to: JBoss 4.x; BEA WebLogic Server 8.1/9.X; 10; IBM Rational Application Developer (6.x or 7.x); Oracle JDeveloper 10g; JBuilder; Apache TomCat; Eclipse Web Tools Project, MyEclipse; and others.

Our lab guides are complete with software-specific instructions, screen shots and detailed tutorials for using the software you select. In most cases we can easily port our classes to run in the environment of your choosing.

For course deliveries or virtual presentation using open-source tools, we'll provide our unique **LoadNGo Instant Classroom Kit**, which enables students to run the entire course off of a DVD that hosts the entire course set up software, labs, and other pertinent useful educational resources, whitepapers and more. You only need to provide the hardware and appropriate O/S, and we'll do the rest. No installation needed. **Great for secure environments.** Minimum set up burden for your team or firm, with maximum results for your students.

No matter which set up option or software your firm requires, we're pleased to provide a detailed set up guide for all private or on-site courses, and as much assistance as you require to prepare your students or classroom for the course. Our support personnel and instructors can be contacted for any advice you may require to prepare your classroom and/or students for attendance.

► **Optional Pre-Testing & Assessment**

We work with you to ensure that your resources are well spent. Through our basic pre-testing, we ensure your team is up to the challenges that this course offers. We will work with you to come up with the best solution to ensure your needs are met, whether we customize the material, or devise a different educational path to prepare for this course.

Please contact us for details about our online pre and post test assessment services, custom managed training plans for one student or your entire organization, and our custom online training program management system for monitoring the courses or progress while skilling your students of all experience levels.

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**Workshop Topics Covered**

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**Need more info?** Please note that a more detailed outline of the course table of contents, lists of lab exercises and project descriptions is available. Please contact us at [Training@triveratech.com](mailto:Training@triveratech.com) for info.

**Need courseware?** This course is fully customizable, and also available for license with complete support for qualified organizations. Please contact [Courseware@triveratech.com](mailto:Courseware@triveratech.com) for details

**Session: Path to Useful Web Services**

**Lesson: Services via the Web**

- What is SOA?
- Characteristics of SOA
- Comparing SOA to OO Design
- Potential Benefits of Service-oriented Systems
- Potential Problems with Service-Oriented Systems
- Discovering Services
- Service Modeling Guidelines
- Business Versus Application
- Preventing Boundary Logic Creep
- Logical Components of a SOA
- Characteristics of a Good Service
- Services and their Formal Contracts
- Services Should be Stateless
- Service Design Guidelines
- SOA Anti-Patterns

**Lesson: Web Services Overview**

- Crossing Boundaries
- What are Web Services?
- Six Key Components
- Web Services Characteristics
- Web Services Architecturally
- Technology Comparison
- Architectural Perspective
- Web Services Enable Decoupling
- Many Web Services Challenges
- Spec and Standard Evolution
- Web Services Interoperability Organization
- WS-I Has Many Deliverables
- Basic Profile 1.0 Consists of:
- Has > 100 Requirements and Suggestions
- .NET Platform & .NET Web Services
- Java and Web Services
- *Exercise: Web Services in Action*

**Lesson: Web Services, Java, and J2EE**

- XML and Java APIs at a Glance
- XML Signature
- XML Digital Signatures
- XML Encryption
- JAXP & JAXB
- JAXP, JAXB, and Web Services
- Web Services APIs at a Glance
- JAX-WS
- SAAJ
- JAX-WSA and XWSS
- Web Services APIs
- Web Services for J2EE (JSR109)

- J2EE and Web Services
- Web Services Metadata
- Web Services Stacks at a Glance
- Apache Axis 1.x
- Apache Axis2
- JBossWS
- JWSDP
- WebSphere WS
- Spring-WS
- Key Features

**Lesson: Web Services – Axis Quickstart**

- What is Axis?
- Axis Tool Support
- How is Apache Axis Used?
- Web Service Development with Axis
- Debugging Web Services
- TCP/IP Monitors Provide View of Wire
- *Exercise: Implementing a Web Service*
- *Exercise: Debugging Web Services*

**Session: Foundation - XML and Java**

**Lesson : XML, Namespaces, & Schema**

- What is XML?
- XML Can Provide Application-Specific Information
- Content: XML Document Syntax Rules
- Structure: A Document Type Definition
- XML Transformation to HTML
- XML Separates Structure, Content

- and Format
- TriveraTunes Purchase Order
- Content as Markup
- Tell Parser That Text is Data
- Use Predefined Entities
- Well-Formed and Valid XML Documents
- Why Are These Definitions Important?
- XML Namespaces
- Name Collision – Example
- Inter-Organization Name Collisions
- W3C’s Solution: Namespaces
- Uniform Resource Indicator
- Declaring a Namespace
- Namespace Scope
- Parsers Use URI, Not the Alias
- Default Namespace
- Attributes and Namespaces
- Example of Namespaces
- Namespaces Best Practices
- Benefits From Valid XML
- W3C XML Schemas
- Impacts of Schemas
- General Form of an XML Schema
- Elements, Attributes, and Types
- Simple Schema and XML Document
- Element Definitions
- Corresponding XML Schema
- Simple Types - Primitive Datatypes
- Restricting Simple Types: Facets
- Complex Types Bring More to Validation
- Repetition Control
- Restricting Simple Types
- Complex Types Can be Derived
- Derivation by Extension
- Extension of Phone Number
- Associating Schemas with XML Instances
- Using XML Schema with Namespaces
- Namespaces Provide Thread of Connection
- Schema Defines a Target Namespace
- XML Doc Uses Schema-Defined Namespace
- schemaLocation Links Namespace to Location
- Relating Schemas to XML
- *Exercise: Namespaces and Schemas*

**Lesson: XML in Java - JAXP and JAXB**

- XML Parsers Are Complex and Powerful

- Parsers Are Integral to XML Processing
- Parsers and API’s
- Parser Generates DOM, Then Hands to App
- Parsing With a DTD or Schema
- Many Options to Consider
- XML and Java
- Bridging Application Data and XML
- JAXP: Java API for XML Processing
- JAXP and Transformations
- Challenges to Mapping XML
- Generating XML is Nondeterministic
- JAXB: Binding XML to Java
- JAXB 2.0 Incorporated Changes
- JAXB 2.0 and Java Versions
- Defining the Rules in JAXB
- Turning Rules into Java Classes
- Using the Generated Classes
- Creating Content
- Some JAXB Type Bindings
- XML Schema for List of Items
- Corresponding Class Interface
- A Word About Validation...
- *Exercise: Working With JAXB*

**Session: Binding – SOAP/REST**

**Lesson : SOAP Overview**

- SOAP in a Nutshell
- Anatomy of a SOAP Message
- SOAP and HTTP
- A Typical Scenario
- What is SOAP?
- SOAP Specification Provides:
- Why do I need SOAP?
- Simple Scenario
- Less Simple Scenario
- Uses of SOAP
- A Simple Example...
- Remote Procedure Calls
- Example of SOAP RPC Call
- Example of Response
- *Exercise: SOAP in Action*

**Lesson: SOAP in Detail**

- Protocols Used With Web Services
- Request and Response Example
- The SOAP Envelope
- SOAP Header
- SOAP Body
- SOAP Request/Response Example
- SOAP Defines a Fault Element

- SOAP Data Model
- Example Using XSD Data Type
- SOAP Styles and Modes
- SOAP With Attachments
- SOAP Messaging
- Endpoint Behavior
- SOAP Encoding Styles
- SOAP 1.1 vs. SOAP 1.2
- What is SAAJ?
- Understanding SAAJ
- SOAPElement
- SOAPElement Methods
- SOAPMessage
- SOAPPart
- SOAPEnvelope
- SOAPBody
- SOAPBodyElement
- SOAPHeaderElement
- SOAPHeaderElement Methods
- SOAPFault
- Connections
- *Exercise: Creating a SOAP Message*
- *Exercise: Accessing a Service with a Servlet*

**Lesson : REST**

- Representational State Transfer
- REST Characteristics
- REST Elements
- REST in Web Service Terms
- REST: Another Option for Binding
- Characterizing REST
- REST Example
- REST Design Principles
- REST/SOAP Comparison
- SOAP vs. REST
- RESTing in Java
- *Exercise: Working With REST (Optional)*

**Session: Description - WSDL**

**Lesson: WSDL**

- Describing Web Services
- WSDL in Practice
- WSDL Extensibility
- WSDL/SOAP Namespaces
- WSDL Elements
- WSDL Anatomy
- <definitions> element
- <documentation> element
- <types> element
- <portType> and <operation>

- <binding> element
- <port> and <service> elements
- Looking Ahead – WSDL 2.0
- *Exercise: WSDL in Action*

**Session: Web Services in Java – JAX-WS/RPC**

**Lesson: JAX-WS/RPC Overview**

- JAX-WS and JAX-RPC
- JAX-RPC Introduction
- JAX-RPC Architecture
- JAX-RPC vs RMI
- JAX-RPC Data Type Mappings
- What about JAXM?
- JAX-WS Overview – The Future
- JAX-WS Under the Hood
- JAX-WS Basics
- JAX-WS Features
- Web Service Annotation Examples
- JAX-WS Programming Model
- JAX-WS Handlers

**Lesson: Working with JAX-WS/RPC**

- JAX-RPC Service
- JAX-RPC Development Process
- Bottom-up Building of a Web Service
- Top-Down Building of a Web Service
- Contract First Approach Has Advantages
- *Exercise: WSDL-Generated Service*
- JAX-RPC Client
- Types of JAX-RPC Clients
- JAX-RPC Basic Client Operations
- Static Web Service Client
- Dynamic JAX-RPC Client
- DII JAX-RPC Client
- SOAP Handlers
- Handlers Applied Via Declaration
- *Exercise: WSDL-Generated Client*

**Session: Web Services in J2EE – WSEE**

**Lesson: Web Services for J2EE (WSEE)**

- WSEE & WSEE Server Programming Model
- Server Programming Model
- Servlets as Web Services
- EJBs as Web Services

- Routing SOAP requests to an EJB
- WSDD
- WSDD Example
- WSEE Client Programming Model
- Client Programming Model
- Types of WSEE Clients
- WSEE Basic Client Operations
- Static WSEE Client
- Dynamic WSEE Client
- DII WSEE Client
- WSEE Client Packaging

**Lesson: Handlers**

- Handlers: The Basics
- WSEE and Handlers
- Handler Life Cycle
- Applying Handlers
- Handler Interface and Implementation
- SOAPMessageContext
- Example of Handler Class
- Configuring Handlers
- Web Service Handler Configuration

**Session: Discovery - UDDI**

**Lesson: UDDI Overview**

- What is UDDI?
- UDDI Background
- UDDI Registries
- Using a UDDI Business Registry
- What is Stored in a Registry?
- The UDDI Information model
- Interacting With UDDI
- JAXR Introduced
- JAXR vs. JNDI
- What is WSIL?
- What is WS-Discovery?
- *Exercise: Discovery in Action*

**Session: Security - WS-Security and Defenses**

**Lesson: XML Signature and Encryption**

- Cryptography Addresses Many Aspects of Security
- Common Solutions to Big Three
- XML Challenges
- XML Signature
- XML Digital Signatures

- XML Signature Usage
- Standard For Digital Signature
- XML Encryption
- XML Encryption Usage
- XML Encryption Protects Data

**Lesson: WS-Security**

- Securing a Web service
- Web Service Security Exposures
- Transport-Level Security
- Secure Sockets Layer (SSL)
- SSL In Action
- When to Use Transport-Level Security
- Message-Level Security
- Web Services Security Roadmap
- WS-Security Enables Interoperability
- Security Tokens; Example of Security Token
- Message Authentication
- XML Signature and Encryption
- Picture is Evolving
- What is XWSS?
- XWSS Provides Many Functions

**Lesson: Securing Untrusted Input**

- Input Data Attacks
- Protecting a Web Service
- Tenacious D
- Defending a Web Service
- Responding to Error State
- Best Practices for Untrusted Data
- Defenses to Consider
- Additional Types of Attacks
- *Exercise: Insecure Web Services*

**Session: Introduction to SOA**

- SOA Overview
- Thinking Services
- Enabling Infrastructure

**Session: Working with SOA**

- Layering of Services
- Legacy Functions and Resources
- Defining and Creating New Services
- Implementing SOA

### ► Why Work With Trivera Technologies?

- **We provide a solid web services development foundation.** Students will learn how to develop (and reuse!) essential Java and web services development and design skills and concepts properly, using best design practices, grounding them for advanced curriculum. Students will be prepared for designing and implementing real solutions, right after the class ends. Students will learn the importance of developing and maintaining well-designed web services applications.
- **Our courses are focused - no "fluff" included.** We offer more than a "laundry list" approach to teaching. All lessons have clear objectives, are fundamental to core development and design practices, and are reinforced by hands-on labs and solid practical examples. Each lesson has performance driven objectives that ensure students will learn technologies and skills core to fundamental application design – nothing more, nothing less. All labs are take-home, and all solution code is presented in an easy to use self-study format for future use and review.
- **Our materials are comprehensive, and current.** Our comprehensive manuals include not only a hard copy of the course presentation, but also detailed reference notes, pertinent diagrams and charts, current lists of suggested online resources and articles, and often technical tutorials or white papers geared to the topics at hand.
- **We set you up!** Hands-on courses also include our unique materials for each student, complete with our **LoadNGo Instant Classroom** course set up DVD, software, and a multitude of learning resources that complement the course. Run the course right off the DVD – minimal set up for your company – maximum results for your students.
- **True content ownership gives us flexibility & quality above the rest.** These course materials are wholly-owned by our company and fully customizable - at little or no cost - to help you best meet your learning objectives. We have many dedicated experts available worldwide to instruct your team, and can provide services around the globe, either locally or virtually. We work closely with you to produce the most effective events and materials for your team, within your desired timeframe and budget.
- **We have to adhere to higher standards.** As a courseware provider, our content and hands-on lab materials are licensed internationally by dozens of firms, and are therefore subject to very stringent quality requirements. Not only will your organization benefit from our own technical team's technical expertise, but also the feedback of hundreds of students and trainers using these materials, worldwide, on a regular basis. This unique fact guarantees that our materials are not only robust and interesting, but also technically correct, current and of the highest quality and usability.
- **We bring years of practical, current experience into the classroom and content.** Our instructors and course authors are also skilled mentors, Java, J2EE / JavaEE, .Net, SOA, and web services developers, architects and security-oriented professionals. We believe that learning, using and maintaining solid software execution and delivery methods are as important as gaining sharp coding skills. Best Practices for software development and execution, beyond technical coding skills, are enforced throughout all of our courses and discussions. Our team brings this extensive experience into every classroom and engagement.
- **We're skills-centric.** Although our team has extensive experience using a variety of tools and solutions, our core content is "technology-centric". Our aim is to teach you the best skills and solutions out there – not to sell you software from any particular vendor.
- **We're Java & J2EE authors and industry speakers.** Our team was selected to write the online *J2EE, EJB, EJB CMP-CMR and Web Services Tutorial Series for IBM developerWorks®* ([www.ibm.com](http://www.ibm.com)) These are the same instructors who train our classes and author the courseware. Most of our trainers/consultants have also authored additional articles on web services, EJB< Struts, J2EE and advanced Java topics, and are recognized speakers and presenters on the industry technical seminar circuit. Our team is comprised on several successful published authors. Members of our team have written or contributed to: *Eclipse Kick Start, Mastering Eclipse; Professional Jakarta Struts; Using Java Tools for Extreme Programming; Mastering Resin; Mastering TomCat and others.*
- **Our services are guaranteed.** Whether you're a stakeholder organizing your firm's educational services, a student in our live or virtual classroom or a trainer using our materials to educate your own client or team – **Our core mission is to make YOU a success in the classroom.**

### ► For Additional Information

**Need dedicated training?** All courses can be brought onsite for a **private presentation**, customized to suit your unique requirements or goals. Please contact [Training@triveratech.com](mailto:Training@triveratech.com) for course details, Public Schedule dates and locations, and Special Discount Offers.

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