



Developing Applications for the Java EE 7 Platform

Student Guide

D98815GC10 | D100413

Author

Vasily Strelnikov

**Technical Contributors
and Reviewers**

Phil Franklin

Girija C

Daniel Milne

Dorin Paraschiv

Jacobo Marcos

Nikolai Elistratov

Editors

Raj Kumar

Vijayalakshmi Narasimhan

Graphic Designer

Kavya Bellur

Publishers

Syed Ali

Pavithran Adka

Raghunath M

Asief Baig

Srividya Rameshkumar

Sumesh Koshy

Jayanthy Keshavamurthy

1009082020

Copyright © 2020, Oracle and/or its affiliates.

Disclaimer

This document contains proprietary information and is protected by copyright and other intellectual property laws. You may copy and print this document solely for your own use in an Oracle training course. The document may not be modified or altered in any way. Except where your use constitutes "fair use" under copyright law, you may not use, share, download, upload, copy, print, display, perform, reproduce, publish, license, post, transmit, or distribute this document in whole or in part without the express authorization of Oracle.

The information contained in this document is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

Restricted Rights Notice

If this documentation is delivered to the United States Government or anyone using the documentation on behalf of the United States Government, the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs) and Oracle computer documentation or other Oracle data delivered to or accessed by U.S. Government end users are "commercial computer software" or "commercial computer software documentation" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, the use, reproduction, duplication, release, display, disclosure, modification, preparation of derivative works, and/or adaptation of i) Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs), ii) Oracle computer documentation and/or iii) other Oracle data, is subject to the rights and limitations specified in the license contained in the applicable contract. The terms governing the U.S. Government's use of Oracle cloud services are defined by the applicable contract for such services. No other rights are granted to the U.S. Government.

Trademark Notice

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Inside are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Epyc, and the AMD logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

Third-Party Content, Products, and Services Disclaimer

This documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

Contents

1 Course Introduction

- Course Objectives 1-2
- Audience 1-3
- Class Introductions 1-4
- Course Environment 1-5
- Course Structure 1-6
- Course Practices 1-7
- Course Appendices 1-8
- Course Schedule 1-9
- Summary 1-10

2 Introduction to Java EE

- Objectives 2-2
- Requirements of Enterprise Applications 2-3
- Separation of Business Logic from Platform Services 2-4
- Structure and Purpose of Java EE 7 Server, Containers, and APIs 2-5
- EJB Lite and EJB Full Containers 2-7
- Evolution of Web Design 2-8
- MVC (Model View Controller) 2-9
- Java EE Web Container Components: Servlets 2-10
- Java EE Web Container Components: JSPs 2-11
- Java EE Web Container Components: JSFs 2-12
- Java EE Web Container Components: REST Services 2-13
- Java EE Web Container Components: Web Sockets 2-14
- Java EE 7 Web Services 2-15
- Java EE 7 Business Logic Handling Technologies 2-16
- Maintaining Application State 2-17
- Session EJB Types 2-18
- Message-Driven EJB 2-20
- Assembling Application Components with CDIs 2-21
- JSF Managed Beans, CDI Beans, EJBs 2-22
- Request Scope 2-23
- Session Scope 2-24
- Application Scope 2-25
- View Scope 2-26

- Conversation Scope 2-27
- Dependent Scope 2-28
- Injecting Beans 2-29
- Java EE Packaging and Deployment 2-30
- Annotations or Deployment Descriptors 2-31
- Annotations with Deployment Descriptors 2-33
- Java Naming Directory Interface Objects 2-34
- Container-Managed Injections 2-36
- JNDI Lookups 2-37
- Summary 2-38
- Practices 2-39

3 Managing Persistence by Using JPA Entities

- Objectives 3-2
- Java Persistence API 3-3
- JPA Entities: Basics 3-5
- Persistent Field Versus Persistent Property 3-8
- Using Access Annotation 3-9
- Converters 3-10
- Generated Keys 3-11
- JPA Lifecycle Callback Methods 3-13
- Validating Entities 3-14
- Using Bean Validation Constraints 3-16
- Container Managed Persistence 3-18
- Locally Managed Persistence 3-21
- Entity Manager Operations 3-23
- Locking and @Version 3-25
- Changing Locking Mode 3-27
- Java Persistence Query Language (JPQL) 3-28
- Using JPQL with non-Entity classes 3-30
- Executing JPQL Statements 3-31
- Summary 3-33
- Practice Overview 3-34

4 Implementing Business Logic by Using EJBs

- Objectives 4-2
- EJBs and EJB Container 4-3
- Enterprise JavaBean Types 4-4
- Session EJBs 4-5
- Accessing Session Beans 4-7
- Stateless Session Bean Life Cycle 4-9

- Stateful Session Bean Life Cycle 4-10
- Singleton Session Bean Life Cycle 4-11
- Asynchronous EJB operations 4-13
- Java Transaction API 4-14
- Programmatic Transactions (BMT) 4-15
- Declarative Transactions (CMT) 4-16
- Demarcate Transactional Attributes 4-17
- Transaction Scoped Beans 4-18
- Timers 4-19
- Calendar-Based Timer Expressions 4-21
- Define Programmatic Timers 4-23
- Define Automatic Timers 4-25
- Manage Timers 4-26
- Define Interceptors 4-27
- Types of Interceptors 4-29
- Apply Interceptors 4-30
- Summary 4-31
- Practice Overview 4-32

5 Using Java Message Service API

- Objectives 5-2
- Java Message Service (JMS) API 5-3
- JMS Destination Types 5-5
- JMS 2.0 API 5-7
- JMS Context 5-9
- Java SE Message Producer 5-11
- Java SE Message Consumer 5-13
- Java SE Asynchronous Producers and Consumers 5-15
- JMS Session Modes and Message Acknowledgments 5-16
- Handle JMS Messages 5-18
- Java EE Message Producer 5-19
- Java EE Message Consumer 5-20
- Topics Shared/Unshared Subscriptions 5-21
- Queue Message Browser 5-22
- Message-Driven Bean (MDB) 5-23
- MDB Life Cycle 5-25
- JMS and Transactions 5-26
- Handle Errors with Transactions 5-27
- Summary 5-28
- Practice Overview 5-29

6 Implementing SOAP Services by Using JAX-WS

- Objectives 6-2
- WebServices and SOAP 6-3
- Web Service Interaction Patterns 6-4
- Web Service Interface 6-5
- XML Schema Definition 6-6
- WSDL Schemas and Namespaces 6-8
- WSDL Messages, PortTypes, and Operations 6-9
- WSDL Bindings and Services 6-10
- Top-down versus Bottom-up approach 6-12
- Map Java Interface to WSDL 6-13
- JAX-WS Implementation 6-15
- Create JAVA JAX-WS Client 6-16
- Invoke SOAP Service from Java SE Client 6-19
- Invoke SOAP Service from Java EE Component 6-20
- Summary 6-21
- Practice Overview 6-22

7 Creating Java Web Applications by Using Servlets

- Objectives 7-2
- HTTP Protocol Basics: Sending Requests 7-3
- HTTP Protocol Basics: Getting Responses 7-4
- Create Servlet 7-5
- Override Servlet Request Handling Operations 7-7
- Provide Request Handling Logic 7-8
- Retrieve Request Headers 7-9
- Retrieve Parameters 7-10
- Use Cookies 7-11
- Produce Different Content Types 7-12
- Manage Servlet Life Cycle with Container Callbacks 7-13
- CDI Beans 7-14
- HTTP Session Tracking 7-15
- Web Container Life Cycle Events 7-16
- Request Dispatcher 7-19
- Servlet Filters 7-21
- Asynchronous Servlets 7-23
- Nonblocking I/O 7-25
- Handle Errors 7-28
- Summary 7-29
- Practice Overview 7-30

8 Creating Java Web Applications by Using JSPs

- Objectives 8-2
- Create Java Server Page 8-3
- Java Server Page Syntax 8-4
- Java Server Page XML Syntax 8-6
- Expression Language 8-7
- Expression Language Operators 8-8
- JSP Scopes and Implicit Objects 8-9
- Use CDI Beans in JSPs 8-10
- Standard Tag Library (JSTL) 8-11
- Create JSP Error Handlers 8-13
- Summary 8-14
- Practice Overview 8-15

9 Implementing REST Services using JAX-RS API

- Objectives 9-2
- REST Service Conventions and Resources 9-3
- REST Communication Model 9-4
- Implementing REST Services using JAX-RS API 9-5
- Mapping Resources to URI Paths 9-7
- Mapping REST Resource Operations 9-8
- Handling Different Media Types 9-9
- Passing Parameters 9-11
- Validating Values 9-12
- Handling Web Service Errors 9-13
- Asynchronous REST Services 9-15
- Asynchronous EJB and REST Services 9-17
- Invoking REST Service from JavaScript Client 9-18
- Invoking REST Service from Java Client 9-19
- Invoking REST Service from Asynchronous Java Client 9-20
- Summary 9-21
- Practice 9-22

10 Creating Java Applications with WebSockets

- Objectives 10-2
- WebSockets Network Protocol 10-3
- WebSocket Life Cycle 10-4
- Defining WebSocket Endpoints 10-5
- Using PathParam Annotation 10-7
- Using WebSocket Session 10-8
- Using RemoteEndpoint Objects 10-10

- Encode and Decode Messages 10-11
- Handle WebSocket Messages 10-12
- Handle WebSocket Errors 10-14
- Encoding and Decoding WebSocket Messages 10-15
- Implementing WebSocket Message Encoder 10-16
- Implementing WebSocket Message Decoder 10-17
- Creating JSON Messages 10-18
- Parsing JSON Messages 10-19
- Invoking WebSocket Server from a JavaScript Client 10-20
- Invoking WebSocket Server from a Java Client 10-21
- Summary 10-22
- Practice 10-23

11 Developing Web Applications Using JavaServer Faces

- Objectives 11-2
- JavaServer Faces Concepts 11-3
- Faces Servlet Registration 11-4
- JSF Configuration 11-5
- JSF Facelet Structure 11-6
- JSF Request-Response Lifecycle 11-7
- JSF Libraries 11-9
- JSF HTML Library UIComponents 11-10
- JSF HTML Passthrough 11-11
- Using Validators and Converters 11-12
- JSF Templates 11-13
- Describe JSF Navigation 11-14
- Configuring Navigation Rules 11-15
- Using Faces Flows 11-16
- Action and ActionListener Attributes 11-17
- Value and Binding Attributes 11-18
- Using immediate attribute 11-19
- Using FacesContext Object 11-20
- JSF Localization 11-21
- Displaying Messages 11-22
- Producing Messages From CDI Beans 11-23
- Using Managed Properties 11-25
- Adding AJAX code to Facelets 11-26
- Extended JSF Frameworks and Component Libraries 11-27
- Summary 11-28
- Practice 11-29

12 Securing Java EE Applications

- Objectives 12-2
- JAAS Security Concepts 12-3
- JAAS Configuration 12-5
- Request Authentication and Authorization 12-7
- Login Module Configuration 12-8
- Programmatic Authentication 12-10
- Declare Application Roles 12-11
- Define Security Constraints 12-12
- Java EE Programmatic Security 12-14
- Web Service Security 12-15
- WS-Security 12-16
- Summary 12-17
- Practice 12-18

A Java Logging

- Objectives A-2
- Java Logging Frameworks A-3
- Using Java Logging API A-4
- Logging Method Categories A-5
- Guarded Logging A-7
- Log Writing Handling A-8
- Logging Configuration A-10
- Application Server Logging Configuration A-11
- Configuring the WebLogic Logging Service A-12
- Viewing WebLogic Server Logs A-13

B CDI Beans

- Objectives B-2
- Using Named Qualifiers B-3
- Using Custom Qualifiers B-4
- Using Alternative Qualifiers B-5
- Producer and Disposer Methods B-6
- Interceptors B-7
- CDI Events B-8
- Stereotypes B-9

C BeanValidation and JPA API

- Objectives C-2
- Custom BeanValidation Constraints C-3
- Entity Relationship Types C-4

- Mapping Entity Relationships C-6
- Entity Relationship Mapping Properties C-7
- Mapping Embeddable Classes C-8
- Mapping an Entity to Multiple Tables C-9
- Composite Primary Key C-11
- Using Inheritance with Entities C-13
- Using Unmapped Superclass C-14
- Using Mapped Superclass C-15
- Entity Inheritance Mapping Strategies C-16

D Batch and Concurrency APIs

- Objectives D-2
- Concurrency D-3
- Executor Service D-5
- Managed Task Listener D-6
- Batch Processing: Overview D-7
- Job Specification Language (JSL) XML Structure D-8
- Batch API Structure D-12
- Describe Job Using JSL XML Document D-14
- Run Batch Job D-15

E JAXB API

- Objectives E-2
- JAXB API E-3
- Bind Java Classes to XML Schema E-4
- Read and Write XML with JAXB E-5
- JAXB Annotations Part I E-6
- JAXB Annotations Part II E-7

F "Pre-CDI" Servlet Examples

- Objectives F-2
- Using Request Application Attributes Without CDI F-3
- Using HttpSession Attributes Without CDI F-4