

Table of Contents

LIST OF PROGRAMS AND SCRIPTS.....	XIII
TABLE OF FIGURES	XXI
PREFACE	XXVII
WHY THIS BOOK.....	XXVII
WHOM THIS BOOK IS FOR	XXVIII
HOW THIS BOOK IS ORGANIZED	XXVIII
SOFTWARE AND HARDWARE	XXIX
HOW TO USE THIS BOOK	XXIX
TYPOGRAPHIC CONVENTIONS	XXIX
HOW TO REACH THE AUTHOR.....	XXX
THE BOOK'S WEB SITE.....	XXX
ACKNOWLEDGEMENTS.....	XXXI
PART I SETTING THE STAGE.....	1
1 INTRODUCTION TO SPRING FRAMEWORKS.....	3
1.1 WHAT IS AN ENTERPRISE APPLICATION?	3

1.2	WHY AN END-TO-END APPROACH?	4
1.3	INVERSION OF CONTROL (IOC) AND DEPENDENCY INJECTION (DI).....	6
1.4	SPRING MODULES	7
1.4.1	<i>Core Container</i>	8
1.4.2	<i>Data Access and Integration</i>	8
1.4.3	<i>Web</i>	9
1.4.4	<i>Aspect Oriented Programming (AOP)</i>	9
1.4.5	<i>Instrumentation</i>	9
1.4.6	<i>Test</i>	9
1.5	SPRING JAR FILES.....	9
1.6	SPRING PORTFOLIO	10
1.7	SUMMARY.....	10
	RECOMMENDED READING	11
	EXERCISES	11
2	SETTING UP A SPRING-BASED SAMPLE ENTERPRISE APPLICATION	13
2.1	SOBA STACK.....	13
2.2	DIFFERENCES AMONG ORACLE, MYSQL, POSTGRESQL AND SQL SERVER.....	14
2.2.1	<i>Data Types</i>	14
2.2.2	<i>Features Supported</i>	15
2.3	SETTING UP MYSQL FOR SOBA.....	16
2.3.1	<i>SOBA Schema</i>	16
2.3.2	<i>SQL Statements for Creating SOBA Objects</i>	18
2.4	SETTING UP SOBA ON ECLIPSE.....	24
2.4.1	<i>Installing Eclipse</i>	24
2.4.2	<i>Importing SOBA</i>	24
2.4.3	<i>Installing Tomcat 7</i>	26
2.5	BUILDING SOBA WITH MAVEN	28
2.5.1	<i>Introduction to Maven</i>	28

2.5.2	<i>Setting up Maven</i>	29
2.5.3	<i>Enabling Maven on Eclipse</i>	29
2.5.4	<i>Building SOBA with Maven</i>	29
2.5.5	<i>SOBA's pom.xml Configuration File</i>	32
2.6	CONFIGURING SOBA TO WORK WITH YOUR DATABASE SYSTEM	32
2.6.1	<i>Configuring SOBA to Work with MySQL 5.5.22</i>	32
2.6.2	<i>Configuring SOBA to Work with PostgreSQL 9.3</i>	33
2.6.3	<i>Configuring SOBA to Work with SQL Server 2012</i>	33
2.6.4	<i>Configuring SOBA to Work with Oracle 11g R2</i>	33
2.7	TESTING SOBA	35
2.7.1	<i>Starting up SOBA</i>	35
2.7.2	<i>Testing SOBA 1: Creating New Customers</i>	36
2.7.3	<i>Testing SOBA 2: Posting Transactions</i>	39
2.7.4	<i>Testing SOBA 3: Paying Bills Online</i>	42
2.8	SUMMARY	44
	<i>RECOMMENDED READING</i>	44
	<i>EXERCISES</i>	44
	PART II SPRING ESSENTIAL ELEMENTS FOR BUILDING ENTERPRISE APPLICATIONS	45
3	SPRING CORE CONCEPTS	47
3.1	THE IOC CONTAINER	47
3.1.1	<i>The POJO and Configuration Metadata</i>	48
3.1.2	<i>Instantiating a Spring IoC Container</i>	50
3.1.3	<i>Using the Container</i>	50
3.1.4	<i>POJOs to Configure As Spring Beans</i>	52
3.2	SPRING BEANS.....	54
3.2.1	<i>Identifying and Naming Beans</i>	55
3.2.2	<i>Instantiating Beans</i>	56
3.3	DEPENDENCY INJECTION (DI)	58

3.3.1	<i>Setter-Based Dependency Injection</i>	58
3.3.2	<i>Constructor-Based Dependency Injection</i>	58
3.3.3	<i>Dependency Resolution Process</i>	59
3.3.4	<i>Using Depends-On</i>	60
3.3.5	<i>Lazy-Initialized Beans</i>	60
3.3.6	<i>Autowiring Collaborators</i>	60
3.3.7	<i>Method Injection</i>	61
3.4	BEAN SCOPES.....	61
3.5	SUMMARY.....	62
	<i>RECOMMENDED READING</i>	62
	<i>EXERCISES</i>	63
4	SPRING WEB MVC FRAMEWORK	65
4.1	ENTERPRISE WEB APPLICATION ARCHITECTURE.....	65
4.1.1	<i>Data Tier</i>	66
4.1.2	<i>Application Tier</i>	66
4.1.3	<i>Web Tier</i>	66
4.1.4	<i>User Tier</i>	66
4.2	MVC ARCHITECTURE IN GENERAL.....	67
4.3	SPRING WEB MVC FRAMEWORK.....	67
4.3.1	<i>Spring DispatcherServlet and WebApplicationContext</i>	68
4.3.2	<i>Bootstrapping and DispatcherServlet Defined in web.xml File</i>	69
4.3.3	<i>Spring Integration with View Technologies</i>	72
4.4	PROGRAMMING LOGIC FLOW WITH SPRING WEB MVC FRAMEWORK.....	75
4.4.1	<i>A Typical Workflow of SOBA Defined in Spring MVC Framework</i>	75
4.4.2	<i>A JSP Login Page Defining a Web Entry Point</i>	77
4.4.3	<i>Handler Mapping</i>	78
4.4.4	<i>Implementing Spring Controllers with Annotations</i>	81
4.4.5	<i>A Typical View Defined in a Spring MVC Web Form</i>	87

4.4.6	<i>A Typical Form Success Controller with Spring ModelAndView</i>	92
4.4.7	<i>POJOs Referenced in the CreateCustomerFormController</i>	94
4.5	SUMMARY	96
	<i>RECOMMENDED READING</i>	96
	<i>EXERCISES</i>	97
5	SPRING DATA ACCESS FRAMEWORK	99
5.1	DEFINING SPRING DATASOURCES	99
5.2	IMPLEMENTING DAO WITH JDBC	102
5.2.1	<i>Defining Domain Objects</i>	103
5.2.2	<i>Defining a DAO Interface</i>	105
5.3	IMPLEMENTING DAO WITH SPRING JDBC TEMPLATE	106
5.3.1	<i>JdbcTemplate.query</i>	110
5.3.2	<i>JdbcTemplate.queryForObject</i>	111
5.3.3	<i>JdbcTemplate.queryForList</i>	111
5.3.4	<i>JdbcTemplate.queryForInt</i>	111
5.3.5	<i>NamedParameterJdbcTemplate.update</i>	111
5.3.6	<i>NamedParameterJdbcTemplate.batchUpdate</i>	111
5.4	SERVICE BEANS	112
5.5	HIBERNATE DATA ACCESS METHOD	114
5.5.1	<i>Benefits of Using Hibernate</i>	114
5.5.2	<i>Hibernate Mapping (HBM)</i>	115
5.5.3	<i>Hibernate Connectivity Configuration</i>	117
5.5.4	<i>Data Access Methods and Transaction Management for Hibernate</i>	118
5.6	SPRING DATA VALIDATION FRAMEWORK	124
5.6.1	<i>Programmatic Logic Flow with the Bill Pay Service</i>	124
5.6.2	<i>Spring Validation Interface</i>	127
5.6.3	<i>JSR-303 Bean Validation</i>	129
5.7	UPGRADING SPRING DEPRECATED SIMPLEJDBCDAOSUPPORT TO 3.2 JDBC SUPPORT	130

5.8	SUMMARY.....	133
	<i>RECOMMENDED READING</i>	133
	<i>EXERCISES</i>	134
6	SPRING RESTFUL WEB SERVICES FRAMEWORK.....	135
6.1	INTRODUCTION TO RESTFUL WEB SERVICES.....	135
6.1.1	<i>Mappings between REST and HTTP</i>	135
6.1.2	<i>RESTful Constraints</i>	136
6.1.3	<i>RESTful Interface Design Principles</i>	137
6.2	SPRING'S SUPPORT FOR RESTFUL WEB SERVICES VIA URI TEMPLATE.....	137
6.3	SERVER CODE.....	138
6.4	CLIENT CODE.....	143
6.5	SUMMARY.....	147
	<i>RECOMMENDED READING</i>	148
	<i>EXERCISES</i>	148
7	SPRING SECURITY FRAMEWORK.....	149
7.1	BASIC CONCEPTS.....	149
7.2	CONFIGURING SECURITY IN SPRING SECURITY FRAMEWORK.....	150
7.2.1	<i>Security Configured in the web.xml File</i>	150
7.2.2	<i>Security Configured in the soba-security.xml File</i>	150
7.3	IMPLEMENTING SPRING SECURITY IN VIEWS.....	155
7.4	SPRING ACL APPLIED TO SOBA.....	156
7.4.1	<i>ACL Tables</i>	156
7.4.2	<i>Configuring Spring ACL</i>	157
7.4.3	<i>Maintaining ACLs for SOBA Domain Objects</i>	159
7.4.4	<i>Applying ACLs to Business Operations</i>	164
7.4.5	<i>Testing ACLs with SOBA</i>	167
7.5	SUMMARY.....	173
	<i>RECOMMENDED READING</i>	174

EXERCISES	174
8 SPRING AOP FRAMEWORK.....	177
8.1 SOBA ADMIN CONSOLE – A RENDEZVOUS FOR CROSSCUTTING CONCERNS	177
8.1.1 SOBA Logging Controller and Performance Profiling Controller	178
8.1.2 Log4jConsole and PerfBasic Profiling Views	183
8.1.3 Logging with Log4j for SOBA	186
8.1.4 Performance Profiling with perfBasic for SOBA	191
8.2 SOLVING CROSSCUTTING CONCERNS WITH DYNAMIC PROXY	193
8.3 SOLVING CROSSCUTTING CONCERNS WITH SPRING AOP-ASPECTJ SUPPORT	200
8.3.1 Basic AOP Concepts	200
8.3.2 Spring and AspectJ Mixed AOP	201
8.4 SUMMARY	208
RECOMMENDED READING	208
EXERCISES.....	209
9 SPRING TESTING.....	211
9.1 UNIT TESTING WITH JUNIT AND TESTNG.....	211
9.1.1 Unit Testing with JUnit 4.....	212
9.1.2 Unit Testing with TestNG.....	215
9.2 INTEGRATION TESTING WITH TESTNG	217
9.2.1 Integration Testing DAOs with InMemoryDaos	217
9.2.2 Integration Testing Service Layer Classes with TestNG	224
9.2.3 Integration Testing with Mock Objects.....	228
9.3 SPRING TESTING SUPPORT	231
9.3.1 Testing Spring MVC Controllers	231
9.3.2 Spring’s TestContext Support for Integration Testing.....	238
9.3.3 Automatically Injecting Spring Test Fixtures into Integration Tests	243
9.3.4 Spring’s Transactional Support for Integration Testing	245
9.3.5 Spring Integration Testing against Real Databases	253

9.4	SPRING JUNIT TESTING ANNOTATIONS	255
9.5	SUMMARY.....	257
9.6	RECOMMENDED READING.....	257
9.7	EXERCISES	257
10	SPRING-EJB INTEGRATION.....	259
10.1	CREATING AN EJB 3 SAMPLE	259
10.1.1	<i>Creating the MySQL Database.....</i>	<i>259</i>
10.1.2	<i>Creating Entities with an EJB 3 project</i>	<i>260</i>
10.1.3	<i>Creating an EJB 3 Stateless Session Bean</i>	<i>276</i>
10.1.4	<i>Modifying persistence.xml to Use the Hibernate JPA Implementation.....</i>	<i>281</i>
10.1.5	<i>Creating a JBoss Specific EJB 3 Test Client</i>	<i>282</i>
10.1.6	<i>Running the EJB 3 Sample on Jboss.....</i>	<i>284</i>
10.2	ACCESSING EJB 3 COMPONENTS FROM SPRING.....	286
10.2.1	<i>Creating a Spring-EJB integration package.....</i>	<i>286</i>
10.2.2	<i>Creating the Spring Bean that Consumes the EJB Component</i>	<i>287</i>
10.2.3	<i>Creating Spring-EJB Integration Bean Configuration Files</i>	<i>288</i>
10.2.4	<i>Creating a Spring-EJB Integration Test Driver.....</i>	<i>291</i>
10.2.5	<i>Running the Spring-EJB Test Driver</i>	<i>292</i>
10.3	ACCESSING EJB 2.X COMPONENTS	292
10.4	SPRING'S EJB IMPLEMENTATION SUPPORT CLASSES	292
10.5	SUMMARY.....	293
10.6	RECOMMENDED READING.....	293
10.7	EXERCISES	294
11	SPRING WEB FLOW FRAMEWORK	295
11.1	WHY THE SPRING WEB FLOW FRAMEWORK?	295
11.2	INTEGRATING SPRING WEB FLOW FRAMEWORK WITH SPRING MVC FRAMEWORK	296
11.2.1	<i>Configuring Servlet Mappings.....</i>	<i>296</i>
11.2.2	<i>Configuring HandlerMappings and HandlerAdapters.....</i>	<i>299</i>

11.3	SPRING WEB FLOW MECHANICS.....	301
11.3.1	<i>Spring Flow Registry</i>	304
11.3.2	<i>Spring Flow Executor</i>	304
11.4	SPRING WEB FLOW PROGRAMMING.....	306
11.4.1	<i>Defining a Spring web flow</i>	306
11.4.2	<i>Programming Page Views</i>	310
11.5	MODELING WEB FLOWS WITH VARIOUS STATE TYPES.....	314
11.5.1	<i>Built-in Spring Web Flow State Types</i>	314
11.5.2	<i>customerSearch web flow</i>	314
11.6	PERSISTING OBJECTS IN WEB FLOWS: THE TRANSFERMONEY WEB FLOW EXAMPLE.....	323
11.6.1	<i>The Persistable Object TransferRecord</i>	324
11.6.2	<i>The JPA Configuration File persistence.xml</i>	326
11.6.3	<i>Setting up the entityManagerFactory Bean and the jpaTransactionManager Bean ...</i>	327
11.6.4	<i>Registering the transferMoney Flow</i>	328
11.6.5	<i>Defining the transferMoney Flow</i>	329
11.6.6	<i>Programming the Transfer Form and Transfer Review View in JSP Files</i>	330
11.7	SECURING SPRING WEB FLOWS.....	333
11.8	SUMMARY.....	333
11.9	RECOMMENDED READING.....	334
11.10	EXERCISES.....	334
	APPENDIX A SPRING RESOURCES.....	335
A.1	SPRING GUIDES AND TUTORIALS.....	335
A.2	SPRING DOCUMENTATIONS.....	337
A.3	SPRING COMMUNITY DOWNLOADS.....	338
	APPENDIX B CREATING THE SOBA DATABASE.....	339
B.1	SETTING UP THE SOBA DATABASE ON MYSQL.....	339
B.1.1	<i>Setting up a MySQL Environment on Windows</i>	339
B.1.2	<i>Creating SOBA Database on MySQL</i>	341

<i>B.1.3 Exporting and Importing SOBA Database</i>	344
B.2 SETTING UP THE SOBA DATABASE ON POSTGRESQL	344
<i>B.2.1 PostgreSQL on Windows</i>	344
<i>B.2.2 POSTGRESQL ON Linux</i>	346
B.3 SETTING UP THE SOBA DATABASE ON SQL SERVER 2012	347
<i>B.3.1 Setting up a SQL Server 2012 Environment</i>	347
<i>B.3.2 Creating SOBA Database on SQL Server 2012</i>	348
B.4 SETTING UP THE SOBA DATABASE ON ORACLE 11G R2	349
APPENDIX C A SIMPLER SAMPLE BUILT WITH SPRING, HIBERNATE, MYSQL AND MAVEN 3.....	351
C.1 CREATING THE SAMPLE DATABASE	351
C.2 CREATING THE SAMPLE WITH MAVEN	352
C.3 SAMPLE IMPLEMENTATION HIGHLIGHTS	369
<i>C.3.1 The Hibernate Piece</i>	369
<i>C.3.2 The Service Layer</i>	369
<i>C.3.3 The Controller Layer</i>	370
C.4 PROGRAMMATIC LOGIC FLOWS	370
APPENDIX D DEPLOYING/DEVELOPING SOBA ON LINUX	373
D.1 DEPLOYING SOBA ON A LINUX SERVER	373
<i>D.1.1 Installing A JDK</i>	374
<i>D.1.2 Installing Tomcat</i>	374
<i>D.1.3 Installing MySQL</i>	375
<i>D.1.4 Deploying SOBA</i>	376
D.2 DEVELOPING SOBA ON AN UBUNTU LINUX DESKTOP	377
<i>D.2.1 Installing a JDK and Maven</i>	377
<i>D.2.2 Installing Tomcat</i>	377
<i>D.2.3 Installing MySQL</i>	378
<i>D.2.4 Installing Eclipse and Importing SOBA</i>	378
D.3 DEVELOPING SOBA ON AN OPENSUSE LINUX DESKTOP	378

<i>D.3.1 Installing a JDK and ANT</i>	379
<i>D.3.2 Installing Tomcat</i>	379
<i>D.3.3 Installing MySQL</i>	379
<i>D.3.4 Installing Eclipse and Importing SOBA</i>	380
APPENDIX E SOBA ON MAC OS X	381
E.1 INSTALLING A JDK.....	381
E.2 INSTALLING TOMCAT	382
E.3 INSTALLING MYSQL.....	382
E.4 INSTALLING ECLIPSE AND MAVEN	385
E.5 IMPORTING AND BUILDING SOBA	385
E.6 DEPLOYING SOBA.....	386
APPENDIX F DEPLOYING SOBA AND MYNOTES STRAIGHT FROM MAVEN TO TOMCAT 7	387
APPENDIX G DEPLOYING SOBA ON GLASSFISH	389
APPENDIX H DEPLOYING SOBA ON JBOSS	393
APPENDIX I IMPORTING SOBA ONTO STS	395
I.1. INSTALLING STS	395
I.2 STS VERSUS ECLIPSE IDE	396
I.3. IMPORTING SOBA ONTO STS.....	397
APPENDIX J DEPLOYING SOBA ON WEBLOGIC	399
APPENDIX K PUBLISHING AND DEPLOYING SOBA FROM ECLIPSE TO TOMCAT	405
K.1 CREATING A NEW SERVER WITH TOMCAT.....	405
K.2 CONFIGURING THE NEWLY-CREATED TOMCAT SERVER	406
K.3 SETTING PROPER HEAP SIZES FOR TOMCAT	407
K.4 PUBLISHING AND DEPLOYING SOBA FROM ECLIPSE TO TOMCAT	407
INDEX	409