

# Understanding SOA with Web Services

---

*Eric Newcomer and  
Greg Lomow*

◆◆Addison-Wesley

*Upper Saddle River, NJ ■ Boston ■ Indianapolis  
San Francisco ■ New York ■ Toronto ■ Montreal  
London ■ Munich ■ Paris ■ Madrid ■ Capetown  
Sydney ■ Tokyo ■ Singapore ■ Mexico City*

# Contents

---

<b><i>Preface</i></b>	<b>xix</b>
<b><i>Acknowledgments</i></b>	<b>xxi</b>
<b><i>About the Authors</i></b>	<b>xxiii</b>
<b><i>Introduction</i></b>	<b>xxv</b>
<hr/>	
<i>What's in the Book</i>	xxix
<i>Organization of the Book</i>	xxix
<i>Part I</i>	xxx
<i>Part II</i>	xxxii
<b>1 <i>Introduction to SOA with Web Services</i></b>	<b>1</b>
<hr/>	
<i>The Service-Oriented Enterprise</i>	2
<i>Service-Oriented Development</i>	5
<i>Service Abstraction</i>	8
<i>Service-Oriented Architecture</i>	10

<i>What Are Services?</i>	10
<i>What Is Service-Oriented Architecture?</i>	13
<i>Challenges to Adoption</i>	18
<i>SOA and Web Services</i>	20
<i>Rapid Integration</i>	23
<i>Multi-Channel Access</i>	26
<i>Occasionally Connected Computing</i>	28
<i>Business Process Management</i>	29
<i>Extended Web Services Specifications</i>	32
<i>Standardization</i>	32
<i>Specification Composability</i>	35
<i>Metadata Management</i>	38
<i>Security</i>	41
<i>Reliability and Messaging</i>	43
<i>Transactions</i>	44
<i>Orchestration</i>	46
<i>Summary</i>	48

---

**PART I SOA AND BUSINESS PROCESS MANAGEMENT CONCEPTS 49**

---

<b>2 <i>Overview of Service-Oriented Architecture</i></b>	<b>51</b>
<i>Service-Oriented Business and Government</i>	51
<i>Service-Oriented Architecture Concepts</i>	54
<i>SOA Processes, Principles, and Tools</i>	57
<i>Services</i>	58
<i>Line of Business Services</i>	61
<i>Reusable Technical Services</i>	63
<i>Service Contracts</i>	64
<i>Web Services Platform</i>	64
<i>Service Requesters and Service Providers</i>	68

<i>Approved Products, Technologies, and Facilities</i>	69
<i>Service Governance, Processes, Guidelines, Principles, Methods, and Tools</i>	70
<i>SOA Governance Policies and Processes</i>	70
<i>SOA Principles and Guidelines</i>	72
<i>Key Service Characteristics</i>	73
<i>Primary Characteristics</i>	75
<i>Secondary Characteristics</i>	78
<i>SOA Guidelines for Service Requesters</i>	83
<i>SOA Guidelines for Legacy Systems and Legacy Services</i>	85
<i>Technical Benefits of a Service-Oriented Architecture</i>	86
<i>Efficient Development</i>	87
<i>More Reuse</i>	88
<i>Simplified Maintenance</i>	91
<i>Incremental Adoption</i>	91
<i>Graceful Evolution</i>	92
<i>Service-Oriented Architecture—Business Benefits</i>	93
<i>Increased Business Agility</i>	94
<i>Better Business Alignment</i>	96
<i>Improved Customer Satisfaction</i>	98
<i>Reduced Vendor Lock-In and Reduced Switching Costs</i>	99
<i>Reduced Integration Costs</i>	100
<i>Improved ROI of Existing IT Assets</i>	100
<i>Summary</i>	102
<b>3 SOA and Web Services</b>	<b>103</b>
<hr/>	
<i>The Web Services Platform</i>	104
<i>Elements of the Web Services Platform</i>	105
<i>Web Services Platform Principles</i>	108
<i>Service Contracts</i>	109
<i>Service Contract Elements</i>	109
<i>Documenting and Defining Service Contracts</i>	111
<i>Service Contract Principles</i>	112
<i>Service Contracts Focus on Service-Level Abstractions</i>	112

<i>WSDL and Service Contracts</i>	113
<i>WSDL Service Contract Architecture</i>	114
<i>Example WSDL Service Contract—Calendar Service</i>	116
<i>Service-Level Data Model</i>	118
<i>Relationship Between Service-Level Data Models and Internal Data Models</i>	118
<i>Reconciling Disparate Data Models Across Different Service Domains</i>	119
<i>Using XML-Related Technologies for the Service-Level Data Model and Data Handling</i>	122
<i>Service Discovery—Registration and Lookup</i>	123
<i>Service-Level Security</i>	124
<i>Service-Level Interaction Patterns</i>	126
<i>A Quick Look at SOAP and HTTP</i>	127
<i>Request/Response Interactions</i>	129
<i>Request/Callback Interaction Paradigm</i>	130
<i>Asynchronous Store-and-Forward Messaging</i>	132
<i>Example Business Scenario Using Request/Response and Asynchronous Messaging</i>	135
<i>Publish/Subscribe Interaction Paradigm</i>	135
<i>Atomic Services and Composite Services</i>	138
<i>Generating Proxies and Skeletons from Service Contracts</i>	140
<i>Generating Java Classes from Service Contracts</i>	141
<i>Generating C# Classes from Service Contracts</i>	142
<i>Generating C++ Classes from Service Contracts</i>	144
<i>Service-Level Communication and Alternative Transports</i>	145
<i>WSDL Extensibility</i>	146
<i>SOAP over IBM WebSphere MQ</i>	147
<i>SOAP over JMS</i>	147
<i>SOAP over CORBA IIOP</i>	148
<i>SOAP over Tibco Rendezvous</i>	149
<i>A Retrospective on Service-Oriented Architectures</i>	149
<i>Overview of Selected Technologies That Have Been Used to Implement SOAs</i>	150
<i>Detailed Comparison of SOA Technologies</i>	156
<i>Summary</i>	159

<b>4</b>	<b><i>SOA and Web Services for Integration</i></b>	<b>161</b>
	<i>Overview of Integration</i>	162
	<i>Common Business Drivers for Integration</i>	162
	<i>Common Technical Challenges Faced During Integration</i>	164
	<i>Requirements That the “Ideal” Integration Solution Must Satisfy</i>	164
	<i>Integration Can Be Performed at Different Layers of the Technology Stack</i>	166
	<i>Integration and Interoperability Using XML and Web Services</i>	167
	<i>Two Approaches for Using XML and Web Services for Integration and Interoperability</i>	171
	<i>Web Services Integration (WSI)</i>	171
	<i>Service-Oriented Integration (SOI)</i>	174
	<i>Applying SOA and Web Services for Integration—.NET and J2EE Interoperability</i>	178
	<i>Applying SOA and Web Services for Integration—Service-Enabling Legacy Systems</i>	181
	<i>Example #1—CICS and IMS</i>	182
	<i>Example #2—CORBA</i>	188
	<i>Applying SOA and Web Services for Integration—Enterprise Service Bus Pattern</i>	195
	<i>Summary—SOA and Web Services for Integration</i>	197
<b>5</b>	<b><i>SOA and Multi-Channel Access</i></b>	<b>199</b>
	<i>Business Benefits of SOA and Multi-Channel Access</i>	202
	<i>Multi-Channel Access Reduces Staffing Costs</i>	202
	<i>Multi-Channel Access Eliminates Obsolete and Expensive Infrastructure</i>	202
	<i>Service-Oriented Architecture Reduces Costs and Improves Efficiency</i>	202
	<i>A Service-Oriented Architecture for Multi-Channel Access</i>	203
	<i>Architectural Challenges</i>	204
	<i>Architecture for Multi-Channel Access</i>	204
	<i>Client/Presentation Tier</i>	206
	<i>Channel Access Tier</i>	206

<i>Communication Infrastructure</i>	208
<i>Business Service Access Tier</i>	210
<i>Business Service Tier</i>	213
<i>Example—SOA for Developing Composite Applications</i>	214
<i>Example—SOA for Multi-Channel Access Architecture</i>	216
<i>Summary</i>	219

---

**6 SOA and Business Process Management** **221**

<i>Basic Business Process Management Concepts</i>	221
<i>Business Process Management Systems</i>	223
<i>Process Modeling</i>	225
<i>Process Execution</i>	226
<i>Process Monitoring</i>	227
<i>Business Activity Monitoring</i>	227
<i>Example Business Process</i>	229
<i>Combining BPM, SOA, and Web Services</i>	232
<i>Benefits of BPM, SOA, and Web Services</i>	232
<i>Defining Atomic and Composite Services</i>	236
<i>Orchestration and Choreography Specifications</i>	245
<i>Comparing Web Services Orchestration and Choreography</i>	245
<i>WS-BPEL</i>	248
<i>Choreography Description Language</i>	259
<i>Example of Web Services Composition</i>	261
<i>Orchestration-Centric Approach</i>	261
<i>Choreography-Centric Approach</i>	263
<i>Comparing Orchestration-Centric and Choreography-Centric Approaches</i>	265
<i>Part I Summary: Benefits of Combining BPM, SOA, and Web Services</i>	265
<i>Individual Features and Benefits of BPM, SOA, Web Services, and XML</i>	265
<i>Complementary Features and Benefits of BPM, SOA, and Web Services</i>	267

---

**PART II EXTENDED WEB SERVICES SPECIFICATIONS 271**


---

<b>7 Metadata Management</b>	<b>273</b>
<i>The Simple Approach to Metadata Management</i>	276
<i>Using Plain SOAP and WSDL</i>	278
<i>Metadata Specifications</i>	282
XML	283
WSDL 2.0	284
UDDI	286
Addressing	289
<i>Policy</i>	297
WS-Policy	299
Web Services Policy Language (WSPL)	305
WSDL 2.0 Features and Properties	307
Comparing the Policy Specifications	308
WS-MetadataExchange	309
Summary	312
<b>8 Web Services Security</b>	<b>313</b>
Overarching Concern	315
Core Concepts	316
Identity	319
Authentication	320
Digital Signature	321
Summary of Challenges, Threats, and Remedies	321
Message Interception	322
Person in the Middle Attacks	323
Spoofing	323
Replay Attacks	323
Denial-of-Service Attacks	323

<i>Securing the Communications Layer</i>	324
<i>IP Layer Security</i>	325
<i>Transport-Level Security</i>	325
<i>Message-Level Security</i>	327
<i>The WS-Security Framework</i>	327
<i>WS-SecurityPolicy</i>	332
<i>WS-Trust</i>	333
<i>WS-SecureConversation</i>	335
<i>WS-Federation</i>	336
<i>Security Assertion Markup Language (SAML)</i>	337
<i>XACML: Communicating Policy Information</i>	341
<i>XML Key Management Specification (XKMS)</i>	341
<i>Data-Level Security</i>	342
<i>XML Encryption</i>	343
<i>XML Signature</i>	344
<i>Summary</i>	346
<b>9 Advanced Messaging</b>	<b>349</b>
<hr/>	
<i>Reliable Messaging</i>	349
<i>Overview</i>	350
<i>Concepts and Technologies</i>	352
<i>Benefits of Reliable Messaging</i>	357
<i>Usage Scenarios for Reliable Messaging</i>	358
<i>Web Services Reliable Messaging Specifications</i>	362
<i>Comparing Web Services Reliable Messaging and</i> <i>Asynchronous Message Queuing</i>	374
<i>Notification</i>	376
<i>WS-Eventing</i>	378
<i>WS-Notification</i>	379
<i>Mobile Workers and Occasionally Connected Computing</i>	379
<i>Summary</i>	381

<b>10 Transaction Processing</b>	<b>383</b>
<i>Overview</i>	384
<i>The Transaction Paradigm</i>	386
<i>Impact of Web Services on Transactions</i>	387
<i>Protocols and Coordination</i>	389
<i>Activity</i>	389
<i>Context</i>	390
<i>Addressing</i>	391
<i>Policy</i>	392
<i>Coordination</i>	392
<i>Protocol Types</i>	397
<i>Transaction Specifications</i>	401
<i>The Web Services Coordinator</i>	404
<i>WS-AtomicTransaction</i>	409
<i>WS-BusinessActivity</i>	411
<i>WS-Context</i>	412
<i>WS-Coordination Framework</i>	414
<i>WS-Transaction Management</i>	416
<i>Summary</i>	420
<b><i>Bibliography</i></b>	<b>421</b>
<i>Books</i>	421
<i>Technology References</i>	422
<i>Articles</i>	424
<i>Specifications</i>	425
<i>General</i>	425
<i>Metadata</i>	426
<i>Security</i>	427
<i>Reliability</i>	428
<i>Notification</i>	428

xviii Contents

<i>Transactions</i>	428
<i>Orchestration</i>	428
<i>Orchestration Historical References</i>	429
<i>Other Resources</i>	430
<b><i>Index</i></b>	<b>431</b>