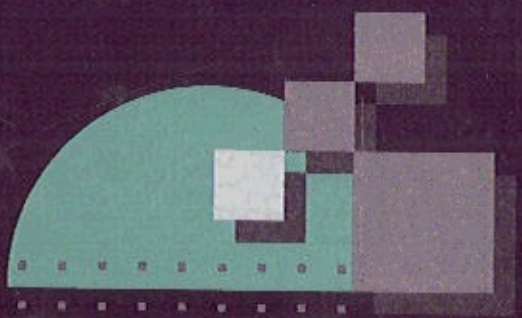
P. A. DARGAN



OPEN SYSTEMS AND STANDARDS

FOR SOFTWARE PRODUCT DEVELOPMENT

Contents

Preface xv
Acknowledgments xvii

CHAPTER 1
Introduction 1
1.1 Promise of Open Systems 1
1.2 Challenges of Open Systems 3
1.3 Who Should Read This Book 4
1.4 How to Get the Most out of This Book 5
1.5 Organization of This Book 6
References 6

CHAPTER 2
Foundational Concepts 9
2.1 What Is an Open System? Key Concepts and Terminology 9
2.2 Process of Defining Standards 17
2.2.1 Formal Standards Bodies Standards Process 18
2.2.2 Vendor Consortia Standards Definition Process 19
2.3 Example Standard Specification 19
2.4 Standards-Based COTS Products 21
2.5 Degrees of Openness 21
2.6 Open Source Versus Open System 21
2.7 Why Standards Are Important for Software Development 22
References 23

CHAPTER 3
Application Standards 25
3.1 E-Business (Electronic-Business) 25
3.1.1 Business Process Execution Language for Web Services 26
3.1.2 Business Process Modeling, Notation, and Language 27
3.1.3 Electronic Business Using eXtensible Markup Language 29
3.1.4 RosettaNet 30
3.1.5 XML Process Definition Language 32
3.1.6 Web Services Choreography Interface 33
3.2 Ontologies 33
References 34

CHAPTER 4

Communications Standards 37

4.1 Asynchronous Transfer Mode 39
4.2 Ethernet (IEEE 802.3) 42
4.3 Fiber Distributed Data Interface 45
4.4 Frame Relay 48
4.5 Internet 49
4.6 Integrated Services Digital Network 55
4.7 Multiprotocol Label Switching 56
4.8 Open Systems Interconnection 57
4.9 Synchronous Optical Network/Synchronous Digital Hierarchy 59
4.10 Voice over IP (H.323) 60
4.11 Wireless 63
4.11.1 Bluetooth (IEEE 802.15) 63
4.11.2 Code Division Multiple Access (IS-95) 64
4.11.3 Global Systems for Mobile Communications 65
4.11.4 Universal Mobile Telecommunications System 67
4.11.5 Wireless Application Protocol 68
4.11.6 Wi-Fi (IEEE 802.11) 68
4.11.7 WiMax (IEEE 802.16) 69
References 70

CHAPTER 5

Data Interchange Standards 73

5.1 Computer Graphics Metafile 73
5.2 Graphics Interchange Format 74
5.3 Joint Photographic Experts Group File Interchange Format 75
5.4 Musical Instrument Digital Interface 76
5.5 Motion Picture Experts Group Layer 3 77
5.6 Motion Pictures Experts Group 78
5.7 OpenGIS Specifications 79
5.8 Portable Document Format 80
5.9 Portable Network Graphics 81
5.10 Rich Text Format 81
5.11 Standard Generalized Markup Language 82
5.12 Tag(ged) Image File Format 83
References 83

CHAPTER 6

Data Management Standards 85

6.1 Database Query Languages 85
6.1.1 Java Database Connectivity 85
6.1.2 Java Data Objects 86
6.1.3 Object Data Management Group Specification 87
6.1.4 Standard Query Language 87
6.2 File Systems for Networks 89
6.2.1 Common Internet File System 90

6.2.2 Direct Access File System 91
6.2.3 Network File System 92
6.3 Metadata and Data Models 92
6.3.1 Common Information Model 93
6.3.2 Common Warehouse Metamodel 94
6.3.3 Open Information Model 95
6.4 Information Management 95
6.4.1 Desktop Management Interface 95
6.5 Storage Areas and Connectivity 96
6.5.1 Fiber Channel over IP 97
6.5.2 Internet Fiber Channel Protocol 98
6.5.3 Internet Small Computer System Interface 98
6.5.4 Storage Management Initiative Specification 99
References 100

CHAPTER 7
Distributed Computing Standards 103
7.1 Active-X/COM/DCOM 103
7.2 CORBA 105
7.3 Distributed Computing Environment 108
7.4 Enterprise Javabeans 109
7.5 Java 2 Platform Specifications (J2EE, J2SE, and J2ME) 110
7.6 Open Grid Services Architecture 113
References 115

CHAPTER 8
Graphics Standards 117
8.1 Graphical Kernel System 118
8.2 Open Graphics Language 119
8.3 Programmer's Hierarchical Interactive Graphics System 120
8.4 Scalable Vector Graphics 121
8.5 Virtual Reality Modeling Language 122
8.6 X3D 123
References 123

CHAPTER 9
Operating System Standards 125
9.1 Linux Standard Base 125
9.2 Portable Operating System Interface 126
9.3 Single UNIX Specification 129
References 129

CHAPTER 10
Security Standards 131
10.1 Strategies for Securing Systems 131
10.1.1 National Security Monitoring 132
10.1.2 Security Threats 133

10.1.3 Access Controls 137
10.1.4 Identification and Authentication 139
10.1.5 Perimeter and Interface Controls 140
10.1.6 Security Policies 143
10.2 Authentication and Identity Management Standards 144
10.2.1 Kerberos 145
10.2.2 Liberty Version 1.0 Specifications 145
10.2.3 Security Assertion Markup Language 146
10.3 Digital Certificate Standards 147
10.3.1 Public-Key Infrastructure X.509 147
10.3.2 X.509 148
10.4 Digital Signature Standards 149
10.4.1 Digital Signature Standard/Federal Information Processing Standard 186-2 149
10.4.2 Rivest-Shamir-Adelman 150
10.5 Encryption Standards 151
10.5.1 Advanced Encryption Standard/FIPS 197 152
10.5.2 Escrowed Encryption Standard/FIPS 185 153
10.5.3 Secure Socket Layer 153
10.5.4 Transport Layer Security 154
10.5.5 Wireless Transport Layer Security 154
References 155

CHAPTER 11
Software Engineering Standards 157

11.1 Architecture Frameworks 157
11.1.1 C4ISR Architecture Framework 157
11.1.2 DoD Architecture Framework 159
11.1.3 Federal Enterprise Architecture 160
11.1.4 Object Management Architecture 162
11.1.5 The Open Group Architecture Framework 163
11.2 Programming Languages 164
11.2.1 Ada 165
11.2.2 C 167
11.2.3 C++ 168
11.2.4 Common Business Oriented Language 169
11.2.5 ECMAScript 170
11.2.6 Formula Translation 171
11.2.7 Java 172
11.2.8 Real-Time Specification for Java 174
11.3 Software Engineering Tools 174
11.3.1 ECMA Framework for Software Engineering Environments 175
11.3.2 Model Driven Architecture 175
11.3.3 Portable Common Tool Environment 177
11.3.4 Unified Modeling Language 178
11.4 Software Engineering Models 179
11.4.1 Capability Maturity Model for Software 179

11.4.2 Capability Maturity Model-Integrated for Systems Engineering/ Software Engineering 180
11.4.3 ISO 9000 182
References 183

CHAPTER 12
System Management Standards 185
12.1 Directory Services 185
12.1.1 Directory Enabled Networks 185
12.1.2 Directory Services Markup Language 187
12.1.3 Lightweight Directory Access Protocol 187
12.1.4 X.500 Directory Services 189
12.2 System Management Data and Capabilities 192
12.2.1 Common Information Model 192
12.2.2 Desktop Management Interface 193
12.2.3 System Management BIOS 193
12.2.4 Web-Based Enterprise Management 194
References 195

CHAPTER 13
User Interface Standards 197
13.1 Motif 197
13.2 Open Motif 198
13.3 X Window System 198
References 199

CHAPTER 14
World Wide Web Standards 201
14.1 Web Markup Languages 201
14.1.1 Directory Services Markup Language 203
14.1.2 HyperText Markup Language 204
14.1.3 Extensible HyperText Markup Language 205
14.1.4 eXtensible Markup Language 207
14.1.5 Wireless Markup Language Specification 208
14.2 Web Protocols 209
14.2.1 HyperText Transfer Protocol 209
14.2.2 Simple Object Access Protocol 210
14.2.3 Wireless Application Protocol 211
14.3 Web Services 211
14.3.1 Semantic Web 214
14.3.2 Universal Description, Discovery, and Integration 215
14.3.3 Web Services Description Language 216
14.3.4 Web Services Choreography Description Language 217
14.3.5 Security Assertion Markup Language 218
14.3.6 XML Key Management Specification 219
14.4 Other Web Developments 219
14.4.1 Virtual Reality Modeling Language 220

14.4.2 Web-Based Enterprise Management 220
14.4.3 Web-Based Distributed Authoring and Versioning 220
14.4.4 X3D 221
References 221

CHAPTER 15
Open Standards Organizations and Vendor Consortia 223
15.1 Formal Standards Bodies 223
15.1.1 American National Standards Institute 223
15.1.2 International Electrotechnical Commission 224
15.1.3 Institute of Electrical and Electronics Engineers 225
15.1.4 International Committee for Information Technology Standards 226
15.1.5 International Organization for Standardization 227
15.1.6 International Telecommunication Union 228
15.1.7 Internet Engineering Task Force 229
15.1.8 National Institute of Standards and Technology 230
15.2 Vendor Organizations and Consortia 231
15.2.1 Asynchronous Transfer Mode Forum 231
15.2.2 Business Process Management Initiative 232
15.2.3 Distributed Management Task Force, Inc. 232
15.2.4 Ecma International 233
15.2.5 European Telecommunications Standards Institute 234
15.2.6 Free Standards Group 234
15.2.7 Global Grid Forum 235
15.2.8 J Consortium (RT Java) 236
15.2.9 Java Community Process 237
15.2.10 Liberty Alliance Project 237
15.2.11 Meta Data Coalition 238
15.2.12 Object Data Management Group 238
15.2.13 Object Management Group 239
15.2.14 Open Geographic Information System Consortium 240
15.2.15 Open Mobile Alliance 240
15.2.16 Organization for the Advancement of Structured Information Standards 241
15.2.17 RosettaNet 242
15.2.18 Storage Networking Industry Association 243
15.2.19 The Open Group 244
15.2.20 Telecommunications Industry Association TIA 245
15.2.21 Web3D Consortium 245
15.2.22 WiMedia Alliance 246
15.2.23 Wireless Application Protocol Forum 246
15.2.24 Workflow Management Coalition 247
15.2.25 World Wide Web Consortium 247
15.2.26 X.Org Foundation 248
References 249

CHAPTER 16

Trends 253

16.1 Trend #1: High-Speed, Ubiquitous, Global Communications 253
16.2 Trend #2: Better Security Mechanisms 254
16.3 Trend #3: Worldwide Electronic Collaboration 256
16.4 Trend #4: Intelligent Push/Pull from Petabyte Data Stores 256
16.5 Trend #5: Seamless Interfaces to Networked Applications and Data 258
16.6 Challenges for Open Systems 260
References 261

CHAPTER 17

Conclusion 263

List of Acronyms 265

About the Author 273

Index 275