ISO/IEC 19500-1:2012-04 (E)

Information technology - Object Management Group - Common Object Request Broker Architecture (CORBA) - P art 1: Interfaces

Contents

Page

Foreword xvii
Introduction xix

1 Scope 1

2 Conformance and Compliance 1

3 Normative References 1

4 Additional Information 2
- 4.1 Outline of Contents 2
- 4.2 Keywords for Requirement Statements 3

5 The Object Model 5
- 5.1 General 5
- 5.2 Overview 5
- 5.3 Object Semantics 6
  - 5.3.1 Objects 6
  - 5.3.2 Requests 6
  - 5.3.3 Object Creation and Destruction 7
  - 5.3.4 Types 7
  - 5.3.5 Interfaces 8
  - 5.3.6 Value Types 9
  - 5.3.7 Abstract Interfaces 9
  - 5.3.8 Operations 9
  - 5.3.9 Attributes 11
- 5.4 Object Implementation 11
  - 5.4.1 The Execution Model: Performing Services 11
  - 5.4.2 The Construction Model 12

6 CORBA Overview 13
- 6.1 General 13

6.2 Structure of an Object Request Broker 13
6.2.1 Object Request Broker 17
6.2.2 Clients 18
6.2.3 Object Implementations 18
6.2.4 Object References 18
6.2.5 OMG Interface Definition Language 19
6.2.6 Mapping of IDL to Programming Languages 19
6.2.7 Client Stubs 19
6.2.8 Dynamic Invocation Interface 19
6.2.9 Implementation Skeleton 20
6.2.10 Dynamic Skeleton Interface 20
6.2.11 Object Adapters 20
6.2.12 ORB Interface 20
6.2.13 Interface Repository 21
6.2.14 Implementation Repository 21
6.3 Example ORBs 21
6.3.1 Client- and Implementation-resident ORB 21
6.3.2 Server-based ORB 21
6.3.3 System-based ORB 22
6.3.4 Library-based ORB 22
6.4 Structure of a Client 22
6.5 Structure of an Object Implementation 23
6.6 Structure of an Object Adapter 25
6.7 CORBA Required Object Adapter 26
6.7.1 Portable Object Adapter 26
6.8 The Integration of Foreign Object Systems 26

7 IDL Syntax and Semantics 29

7.1 Overview 29
7.2 Lexical Conventions 30
7.2.1 Tokens 33
7.2.2 Comments 33
7.2.3 Identifiers 33
7.2.4 Keywords 35
7.2.5 Literals 36
7.3 Preprocessing 38
7.4 IDL Grammar 38

7.5 IDL Specification 45
7.6 Import Declaration 45
7.7 Module Declaration 46
7.8 Interface Declaration 47
7.8.1 Interface Header 47
7.8.2 Interface Inheritance Specification 47
7.8.3 Interface Body 48
7.8.4 Forward Declaration 48
7.8.5 Interface Inheritance 49
7.8.6 Abstract Interface 51
7.8.7 Local Interface 51
7.9 Value Declaration 52
7.9.1 Regular Value Type 52
7.9.2 Boxed Value Type 54
7.9.3 Abstract Value Type 55
7.9.4 Value Forward Declaration 55
7.9.5 Valuetype Inheritance 55
7.10 Constant Declaration 57
7.10.1 Syntax 57
7.10.2 Semantics 58
7.11 Type Declaration 61
7.11.1 Basic Types 62
7.11.2 Constructed Types 64
7.11.3 Template Types 68
7.11.4 Complex Declarator 69
7.11.5 Native Types 69
7.11.6 Deprecated Anonymous Types 70
7.12 Exception Declaration 73
7.13 Operation Declaration 73
7.13.1 Operation Attribute 74
7.13.2 Parameter Declarations 74
7.13.3 Raises Expressions 74
7.13.4 Context Expressions 75
7.14 Attribute Declaration 76
7.15 Repository Identity Related Declarations 77
7.15.1 Repository Identity Declaration 77
7.15.2 Repository Identifier Prefix Declaration 78
7.15.3 Repository Id Conflict 79

7.16 Event Declaration 79
7.16.1 Regular Event Type 79
7.16.2 Abstract Event Type 80
7.16.3 Event Forward Declaration 80
7.16.4 Eventtype Inheritance 80
7.17 Component Declaration 80
7.17.1 Component 80
7.17.2 Component Header 81
7.17.3 Component Body 82
7.17.4 Event Sources—publishers and emitters 84
7.17.5 Event Sinks 84
7.17.6 Basic and Extended Components 85
7.18 Home Declaration 85
7.18.1 Home 85
7.18.2 Home Header 86
7.18.3 Home Body 87
7.19 CORBA Module 88
7.20 Names and Scoping 89
7.20.1 Qualified Names 89
7.20.2 Scoping Rules and Name Resolution 90
7.20.3 Special Scoping Rules for Type Names 93
8 ORB Interface 95
8.1 Overview 95
8.2 The ORB Operations 95
8.2.1 ORB Identity 101
8.2.2 Converting Object References to Strings 101
8.2.3 Getting Service Information 102
8.2.4 Creating a New Context 102
8.2.5 Thread-Related Operations 102
8.3 Object Reference Operations 105
8.3.1 Determining the Object Interface 107
8.3.2 Duplicating and Releasing Copies of Object References 107
8.3.3 Nil Object References 107
8.3.4 Equivalence Checking Operation 108
8.3.5 Probing for Object Non-Existence 108
8.3.6 Object Reference Identity 108
8.3.7 Type Coercion Considerations 110
8.3.8 Getting Policy Associated with the Object 110

8.3.9 Overriding Associated Policies on an Object Reference 111
8.3.10 Validating Connection 112
8.3.11 Getting the Domain Managers Associated with the Object 112
8.3.12 Getting Component Associated with the Object 113
8.3.13 Getting the ORB 113
8.3.14 LocalObject Operations 113
8.4 ValueBase Operations 114
8.5 ORB and OA Initialization and Initial References 115
8.5.1 ORB Initialization 115
8.5.2 Obtaining Initial Object References 117
8.5.3 Configuring Initial Service References 120
8.6 Context Object 122
8.6.1 Introduction 122
8.6.2 Context Object Operations 122
8.7 Current Object 125
8.8 Policy Object 126
8.8.1 Definition of Policy Object 126
8.8.2 Creation of Policy Objects 127
8.8.3 Usages of Policy Objects 129
8.8.4 Policy Associated with the Execution Environment 129
8.8.5 Specification of New Policy Objects 130
8.8.6 Standard Policies 131
8.9 Management of Policies 131
8.9.1 Client Side Policy Management 131
8.9.2 Server Side Policy Management 132
8.9.3 Policy Management Interfaces 132
8.10 Management of Policy Domains 134
8.10.1 Basic Concepts 134
8.10.2 Domain Management Operations 136
8.11 TypeCodes 138
8.11.1 The TypeCode Interface 138
8.11.2 TypeCode Constants 142
8.11.3 Creating TypeCodes 143
8.12 Exceptions 148
8.12.1 Definition of Terms 148
8.12.2 System Exceptions 148
8.12.3 Standard System Exception Definitions 150
8.12.4 Standard Minor Exception Codes 156

9 Value Type Semantics 157
9.1 Overview 157
9.2 Architecture 157
9.2.1 Abstract Values 158
9.2.2 Operations 158
9.2.3 Value Type vs. Interfaces 159
9.2.4 Parameter Passing 159
9.2.5 Substitutability Issues 160
9.2.6 Widening/Narrowing 161
9.2.7 Value Base Type 161
9.2.8 Life Cycle issues 161
9.2.9 Security Considerations 162
9.3 Standard Value Box Definitions 162
9.4 Language Mappings 163
9.4.1 General Requirements 163
9.4.2 Language Specific Marshaling 163
9.4.3 Language Specific Value Factory Requirements 163
9.4.4 Value Method Implementation 164
9.5 Custom Marshaling 164
9.5.1 Implementation of Custom Marshaling 164
9.5.2 Marshaling Streams 165
9.6 Access to the Sending Context Run Time 171
10 Abstract Interface Semantics 173
10.1 Overview 173
10.2 Semantics of Abstract Interfaces 173
10.3 Usage Guidelines 174
10.4 Example 174
10.5 Security Considerations 175
10.5.1 Passing Values to Trusted Domains 175
11 Dynamic Invocation Interface 177
11.1 Overview 177
11.1.1 Common Data Structures 177
11.1.2 Memory Usage 179
11.1.3 Return Status and Exceptions 179

11.2 Request Operations 179
11.2.1 create_request 180
11.2.2 add_arg 182
11.2.3 invoke 182
11.2.4 delete 183
11.2.5 send 183
11.2.6 poll_response 183
11.2.7 get_response 183
11.2.8 sendp 184
11.2.9 prepare 184
11.2.10 sendc 184
11.3 ORB Operations 185
11.3.1 send_multiple_requests 185
11.3.2 get_next_response and poll_next_response 185
11.4 Polling 186
11.4.1 Abstract Valuetype Pollable 187
11.4.2 Abstract Valuetype DIIPollable 188
11.4.3 interface PollableSet 188
11.5 List Operations 189
11.5.1 create_list 190
11.5.2 add_item 190
11.5.3 free 191
11.5.4 free_memory 191
11.5.5 get_count 191
11.5.6 create_operation_list 191
12 Dynamic Skeleton Interface 193
12.1 Introduction 193
12.2 Overview 193
12.3 ServerRequestPseudo-Object 194
12.3.1 ExplicitRequest State: ServerRequestPseudo-Object 194
12.4 DSI: Language Mapping 195
12.4.1 ServerRequest's Handling of Operation Parameters 195
12.4.2 Registering Dynamic Implementation Routines 195
13 Dynamic Management of Any Values 197
13.1 General 197
13.2 Overview 197

13.3 DynAny API 198
13.3.1 Creating a DynAny Object 204
13.3.2 The DynAny Interface 206
13.3.3 The DynFixed Interface 210
13.3.4 The DynEnum Interface 210
13.3.5 The DynStruct Interface 211
13.3.6 The DynUnion Interface 212
13.3.7 The DynSequence Interface 214
13.3.8 The DynArray Interface 215
13.3.9 The DynValueCommon Interface 216
13.3.10 The DynValue Interface 216
13.3.11 The DynValueBox Interface 217
13.4 Usage in C++ Language 218
13.4.1 Dynamic Creation of CORBA::Any values 218
13.4.2 Dynamic Interpretation of CORBA::Any values 219
14 The Interface Repository 221
14.1 Overview 221
14.2 Scope of an Interface Repository 221
14.3 Implementation Dependencies 223
14.3.1 Managing Interface Repositories 223
14.4 Basics 224
14.4.1 Names and Identifiers 224
14.4.2 Types and TypeCodes 225
14.4.3 Interface Repository Objects 225
14.4.4 Structure and Navigation of the Interface Repository 226
14.5 Interface Repository Interfaces 228
14.5.1 Supporting Type Definitions 229
14.5.2 IRObject 230
14.5.3 Contained 231
14.5.4 Container 233
14.5.5 IDLType 238
14.5.6 Repository 238
14.5.7 ModuleDef 240
14.5.8 ConstantDef 240
14.5.9 TypedefDef 241
14.5.10 StructDef 241
14.5.11 UnionDef 242
14.5.12 EnumDef 243
14.5.13 AliasDef 243

14.5.14 PrimitiveDef 244
14.5.15 StringDef 244
14.5.16 WstringDef 244
14.5.17 FixedDef 245
14.5.18 SequenceDef 245
14.5.19 ArrayDef 245
14.5.20 ExceptionDef 246
14.5.21 AttributeDef 247
14.5.22 ExtAttributeDef 247
14.5.23 OperationDef 248
14.5.24 InterfaceDef 250
14.5.25 ExtInterfaceDef 252
14.5.26 AbstractInterfaceDef 253
14.5.27 ExtAbstractInterfaceDef 254
14.5.28 LocalInterfaceDef 255
14.5.29 ExtLocalInterfaceDef 256
14.5.30 ValueMemberDef 256
14.5.31 ValueDef 257
14.5.32 ExtValueDef 260
14.5.33 ValueBoxDef 262
14.5.34 NativeDef 262
14.6 Component Interface Repository Interfaces 262
14.6.1 ComponentIR::Container 262
14.6.2 ComponentIR::Repository 264
14.6.3 ComponentIR::ProvidesDef 265
14.6.4 ComponentIR::UsesDef 265
14.6.5 ComponentIR::EventDef 266
14.6.6 ComponentIR::EventPortDef 266
14.6.7 ComponentIR::EmitsDef 267
14.6.8 ComponentIR::PublishesDef 268
14.6.9 ComponentIR::ConsumesDef 268
14.6.10 ComponentIR::ComponentDef 268
14.6.11 ComponentIR::FactoryDef 271
14.6.12 ComponentIR::FinderDef 272
14.6.13 ComponentIR::HomeDef 272
14.7 RepositoryIds 274
14.7.1 IDL Format 275
14.7.2 RMI Hashed Format 275
14.7.3 DCE UUID Format 277
14.7.4 LOCAL Format 277
14.7.5 Pragma Directives for RepositoryId 277
14.7.6 For More Information 282

14.7.7 RepositoryIDs for OMG-Specified Types 282
14.7.8 Uniqueness Constraints on Repository IDs 283
14.8 IDL for Interface Repository 284

15 The Portable Object Adapter 303

15.1 Overview 303
15.2 Abstract Model Description 303
15.2.1 Model Components 303
15.2.2 Model Architecture 305
15.2.3 POA Creation 306
15.2.4 Reference Creation 307
15.2.5 Object Activation States 308
15.2.6 Request Processing 308
15.2.7 Implicit Activation 309
15.2.8 Multi-threading 310
15.2.9 Dynamic Skeleton Interface 311
15.2.10 Location Transparency 312
15.3 Interfaces 312
15.3.1 The Servant IDL Type 313
15.3.2 POAManager Interface 314
15.3.3 POAManagerFactory Interface 318
15.3.4 AdapterActivator Interface 319
15.3.5 ServantManager Interface 320
15.3.6 ServantActivator Interface 321
15.3.7 ServantLocator Interface 323
15.3.8 POA Policy Objects 325
15.3.9 POA Interface 328
15.3.10 Current Operations 337
15.4 IDL for PortableServer Module 338
15.5 UML Description of PortableServer 344
15.6 Usage Scenarios 346
15.6.1 Getting the Root POA 346
15.6.2 Creating a POA 347
15.6.3 Explicit Activation with POA-assigned Object Ids 347
15.6.4 Explicit Activation with User-assigned Object Ids 348
15.6.5 Creating References before Activation 349
15.6.6 Servant Manager Definition and Creation 349
15.6.7 Object Activation on Demand 351
15.6.8 Persistent Objects with POA-assigned Ids 352

15.6.9 Multiple Object Ids Mapping to a Single Servant 352
15.6.10 One Servant for All Objects 352
15.6.11 Single Servant, Many Objects and Types, Using DSI 355

16 Portable Interceptors 359

16.1 Introduction 359
16.1.1 Object Creation 359
16.1.2 Client Sends Request 360
16.1.3 Server Receives Request 361
16.1.4 Server Sends Reply 361
16.1.5 Client Receives Reply 362

16.2 General Behavior of Local Objects 362

16.3 Interceptor Interface 362

16.4 Request Interceptors 363
16.4.1 Design Principles 363
16.4.2 General Flow Rules 364
16.4.3 The Flow Stack Visual Model 364
16.4.4 The Request Interceptor Points 365
16.4.5 Client-Side Interceptor 365
16.4.6 Client-Side Interception Points 365
16.4.7 Client-Side Interception Point Flow 367
16.4.8 Server-Side Interceptor 370
16.4.9 Server-Side Interception Points 370
16.4.10 Server-Side Interception Point Flow 372
16.4.11 Request Information 375
16.4.12 RequestInfo Interface 375
16.4.13 ClientRequestInfo Interface 379
16.4.14 ServerRequestInfo Interface 382
16.4.15 ForwardRequest Exception 386

16.5 Portable Interceptor Current 386
16.5.1 Overview 386
16.5.2 Obtaining the Portable Interceptor Current 386
16.5.3 Portable Interceptor Current Interface 387
16.5.4 Use of Portable Interceptor Current 388

16.6 IOR Interceptor 392
16.6.1 Overview 392
16.6.2 An Abstract Model for Object Adapters 392
16.6.3 Object Reference Template 394
16.6.4 IORInterceptor Interface 396
16.6.5 IORInfo Interface 397

16.7 Interceptor Policy Objects 400
16.7.1 ProcessingMode Policy 400
16.8 PolicyFactory 401
16.8.1 PolicyFactory Interface 401
16.9 Registering Interceptors 401
16.9.1 ORBInitializer Interface 401
16.9.2 ORBInitInfo Interface 402
16.9.3 register_orb_initializer Operation 406
16.9.4 Notes about Registering Interceptors 408
16.10 Dynamic Initial References 409
16.10.1 register_initial_reference 409
16.11 Module Dynamic 410
16.11.1 NVList PIDL Represented by ParameterList IDL 410
16.11.2 ContextList PIDL Represented by ContextList IDL 410
16.11.3 ExceptionList PIDL Represented by ExceptionList IDL 410
16.11.4 Context PIDL Represented by RequestContext IDL 410
16.12 Consolidated IDL 410
16.12.1 Dynamic 410
16.12.2 Portions of IOP Relevant to Portable Interceptor 411
16.12.3 PortableInterceptor 412

17 CORBA Messaging 417

17.1 General 417
17.2 Quality of Service 417
17.3 Messaging Quality of Service 417
17.3.1 Rebind Support 419
17.3.2 Synchronization Scope 420
17.3.3 Request and Reply Priority 421
17.3.4 Request and Reply Timeout 422
17.3.5 Routing 424
17.3.6 Queue Ordering 425
17.4 Propagation of Messaging QoS 426
17.4.1 Structures 426
17.4.2 Messaging QoS Profile Component 426
17.4.3 Messaging QoS Service Context 426
17.5 Messaging Programming Model 427
17.6 Running Example 428

17.7 Async Operation Mapping 428
17.7.1 Callback Model Signatures (sendc) 429
17.7.2 Polling Model Signatures (sendp) 431
17.8 Exception Delivery in the Callback Model 433
17.8.1 Messaging::ExceptionHolder valuetype 433
17.9 Type-Specific ReplyHandler Mapping 433
17.9.1 ReplyHandler Operations for NO_EXCEPTION Replies 434
17.9.2 ReplyHandler Operations for Exceptional Replies 435
17.9.3 Example 435
17.10 Generic Poller Value 436
17.10.1 operation_target 437
17.10.2 operation_name 437
17.10.3 associated_handler 437
17.10.4 is_from_poller 437
17.11 Type-Specific Poller Mapping 437
17.11.1 Basic Type-Specific Poller 438
17.11.2 Persistent Type-Specific Poller 440
17.11.3 Example 440
17.12 Example Programmer Usage 441
17.12.1 Example Programmer Usage (Examples Mapped to C++) 441
17.12.2 Client-Side C++ Example for the Asynchronous Method Signatures 441
17.12.3 Client-Side C++ Example of the Callback Model 442
17.12.4 Client-Side C++ Example of the Polling Model 449
17.12.5 Server Side 454
17.13 Message Routing Interoperability 455
17.14 Routing Object References 456
17.15 Message Routing 457
17.15.1 Structures 459
17.15.2 Interfaces 460
17.15.3 Routing Protocol 462
17.16 Router Administration 467
17.16.1 Constants 470
17.16.2 Exceptions 470
17.16.3 Valuetypes 471
17.16.4 Interfaces 471
17.17 CORBA Messaging IDL 472
17.17.1 Messaging Module 472
17.17.2 MessageRouting Module 475

Chapter 17 Annexes

A.1 QoS Abstract Model Design 480
A.2 Model Components 480
A.2.1 Component Relationships 481
A.2.2 Component Design 481
A.3 AMI/TII Abstract Model Design 482
A.3.1 Asynchronous Method Invocation Components 482
A.3.2 Time-Independent Invocation Components 483
A.3.3 Component Relationships 483
A.3.4 Callback Model Detailed Design 486
A.3.5 Poller/PersistentRequest Detailed Design 487
A.4 Message Routing Abstract Model Design 488
A.4.1 Model Components 489
A.4.2 Component Relationships 489
A.4.3 Router Administration Design 489
B.1 Conformance Issues 491
B.2 Compatibility Issues 491
B.2.1 Transaction Service 491
B.2.2 Changes to Current OTS Behavior 491
B.2.3 Security Service 492

Annex A - IDL Tags and Exceptions 493
Annex B - Legal Information 507