ISO/IEC 13818-6:1998-09 (E)

Information technology - Generic coding of moving pictures and associated audio information - Part 6: Extensions for DSM-CC

Contents

Page

0. INTRODUCTION xix
0.1 Guiding Factors in the Formulation of DSM-CC xix
0.2 DSM-CC Client-Network-Server Model xx
0.3 Oudine of the DSM-CC Specification xx
0.3.1 User-to-Network xx
0.3.2 User-to-User xxi
0.4 Supported Network Technologies xxi
0.5 Supported Connection Types xxi
0.6 DSM-CC Interfaces xxi
0.7 DSM-CC Interface Protocols xxiii
0.8 Communications Requirements xxv
0.9. Methods of Specification xxv
0.9.1 Messages xxv
0.9.2 Message Flow Diagram Scenarios xxvi
0.9.3 Specification and Description Language xxvi
0.9.4 Interface Definition Language (IDL) xxviii
0.9.5 Remote Procedure Call (RPC) xxviii
0.9.5.1 Independence of RPC xxix
0.9.5.2 Preferred and Default RPC xxix
0.9.5.3 Local Equivalent Functions xxix

1. GENERAL 1
1.1 Scope 1
1.2 Profiles and Compliance 1
1.2.1 Functional Categories of the DSM-CC protocols 1
1.2.2 User-to-Network Session Messages 2
1.2.2.1 U-N Core Session Message Functional Croups 2
1.2.2.2 U-N Extended Session Message Functional Groups 2
1.2.3 User-User Interfaces 2
1.2.3.1 U-U Core Interfaces 2
1.2.3.2 U-U Extended Interfaces 3
1.3 Definitions 3
1.4 Acronyms 4
1.5 Normative References 6
2. DSM-CC MESSAGE HEADER 7
2.1 DSM-CC Adaptation Header Format 8
2.1.1 DSM-CC Conditional Access Adaptation Format 9
2.1.2 DSM-CC User ID Adaptation Format 9

3. USER-TO-NETWORK CONFIGURATION MESSAGES 10
3.1 Overview and the General Message Format 10
3.2 User-to-Network configuration parameters 10
3.2.1 DSM-CC specific configuration parameters 10
3.2.2 Network specific configuration parameters 1 1
3.2.3 User defined configuration parameters 12
3.3 User to Network Configuration Messages 12
3.3.1 UNConfigRequest message definition 13
3.3.2 UNConfigConfirm message definition 13
3.3.3 UNConfigIndication message definition 14
3.3.4 UNConfigResponse message definition 14
3.4 User-to-Network Configuration Message Field Data Types 15
3.5 User Initiated UNConfigRequest message Sequence 15

3.6 Network Initiated UNConfigIndication message Sequence 16
3.7 Broadcasting of UNConfigIndication messages 16
3.8 Mixed User/Network Initiated Configuration Sequences 17
3.9 User-to-Network Configuration Reason Codes 17
3.10 User-to-Network Configuration Response Codes 17

4. USER-TO-NETWORK SESSION MESSAGES 19
4.1 Overview and the General Message Format 19
4.2 Session Messages 19
4.2.1 U-N Functional groups 23
4.2.1.1 U-N Core Group 23
4.2.1.2 Extended Functional groups 24
4.2.2 Use of UserData() structure in session messages 24
4.2.3 Use of Resources() structure in session messages 25
4.2.4 Session Set-Up group message definitions 25
4.2.4.1 ClientSessionSetUpRequest 25
4.2.4.2 ClientSessionSetUpConfirm 26
4.2.4.3 ServerSessionSetUpIndication 27
4.2.4.4 ServerSessionSetUpResponse 27
4.2.5 Session Release group message definitions 28
4.2.5.1 ClientSessionReleaseRequest 28
4.2.5.2 ClientSessionReleaseConfirm 29
4.2.5.3 ClientSessionReleaseIndication 29
4.2.5.4 ClientSessionReleaseResponse 29
4.2.5.5 ServerSessionReleaseRequest 30
4.2.5.6 ServerSessionReleaseConfirm 30
4.2.5.7 ServerSessionReleaseIndication 31
4.2.5.8 ServerSessionReleaseResponse 31
4.2.6 Add Resource group message definitions 32
4.2.6.1 ClientAddResourceIndication 32
4.2.6.2 ClientAddResourceResponse 32
4.2.6.3 ServerAddResourceRequest 33
4.2.6.4 Server AddResourceConfirm 33
4.2.7 Delete Resource group message definitions 34
4.2.7.1 ClientDeleteResourceIndication 34
4.2.7.2 ClientDeleteResourceResponse 35
4.2.7.3 ServerDeleteResourceRequest 35
4.2.7.4 ServerDeleteResourceConfirm 36
4.2.8 Continuous Feed Session group message definitions 36
4.2.8.1 ServerContinuousFeedSessionRequest 36
4.2.8.2 ServerContinuousFeedSessionConfirm 37
4.2.9 Status group message definitions 37
4.2.9.1 ClientStatusRequest 37
4.2.9.2 ClientStatusConfirm 38
4.2.9.3 ClientStatusIndication 38
4.2.9.4 ClientStatusResponse 38
4.2.9.5 ServerStatusRequest 39
4.2.9.6 ServerStatusConfirm 39
4.2.9.7 ServerStatusIndication 40
4.2.9.8 ServerStatusResponse 40
4.2.10 Reset group message definitions 41
4.2.10.1 ClientResetRequest 41
4.2.10.2 ClientResetConfirm 41
4.2.10.3 ClientResetIndication 42
4.2.10.4 ClientResetResponse 42
4.2.10.5 ServerResetRequest 42
4.2.10.6 ServerResetConfirm 43
4.2.10.7 ServerResetIndication 43
4.2.10.8 ServerResetResponse 43
4.2.11 Session Proceeding group message definitions 44
4.2.11.1 ClientSessionProceedingIndication 44
4.2.11.2 ServerSessionProceedingIndication 44

4.2.12 Connect group message definitions 44
4.2.12.1 ClientConnectRequest 44
4.2.12.2 ServerConnectIndication 45
4.2.13 Session Transfer group message definitions 45
4.2.13.1 ClientSessionTransferIndication 45
4.2.13.2 ClientSessionTransferResponse 46
4.2.13.3 ServerSessionTransferRequest 46
4.2.13.4 ServerSessionTransferConfirm 47
4.2.13.5 ServerSessionTransferIndication 47
4.2.13.6 ServerSessionTransferResponse 48
4.2.14 Session In Progress group message definitions 49
4.2.14.1 ClientSessionInProgress 49
4.2.14.2 ServerSessionInProgress 49
4.3 User-to-Network Session Message Field Data Types 49
4.4 Reason Codes 52
4.5 Response Codes 53
4.6 MPEG-2 DSM-CC statusTypes 55
4.7 Resource Descriptors 56
4.7.1 DSM-CC User-to-Network Resource Descriptor 56
4.7.2 Specifying Ranges and Lists of values in resource descriptors 62
4.7.3 Horizontal Association of Resource Descriptors 64
4.7.4 Vertical Resource Sharing 64
4.7.5 Resource Descriptor Definitions 65
4.7.5.1 ContinuousFeedSession resource descriptor definition 66
4.7.5.2 AtmConnection resource descriptor definition 67
4.7.5.3 MpegProgram resource descriptor definition 67
4.7.5.4 Physical Channel resource descriptor definition 68
4.7.5.5 TSUpstreamBandwidth resource descriptor definition 69
4.7.5.6 TSDownstreamBandwidth resource descriptor definition 69
4.7.5.7 AtmSvcConnection resource descriptor definition 70
4.7.5.8 ConnectionNotify resource descriptor definition 70
4.7.5.9 IP resource descriptor definition 70
4.7.5.10 ClientTdmaAssignment resource descriptor definition 71
4.7.5.11 PSTNSetup resource descriptor definition 71
4.7.5.12 NISDNSetup resource descriptor definition 71
4.7.5.13 NISDNConnection resource descriptor definition 72
4.7.5.14 Q922Connections resource descriptor definition 72
4.7.5.15 SharedResource resource descriptor definition 72
4.7.5.16 SharedRequestId resource descriptor definition 72
4.7.5.17 HeadEndList resource descriptor definition 73
4.7.5.18 AtmVcConnection resource descriptor definition 73
4.7.5.19 SdbContinuousFeed resource descriptor definition 74
4.7.5.20 SdbAssociations resource descriptor definition 74
4.7.5.21 SdbEntitlement resource descriptor definition 75
4.8 Client Initiated Command Sequences 75
4.8.1 Client Session Set-Up Command Sequence 76
4.8.1.1 Client Initiales Session Set-Up Request 76
4.8.1.2 Network Rejects Client Session Request 78
4.8.1.3 Server Rejects Server Session Indication 78
4.8.1.4 Client Has Final UserDataQ 79
4.8.1.5 Client Initiates Early Release 79
4.8.1.6 Server Does not respond to serverSessionSetUpIndication 80
4.8.1.7 Network Rejects Server's Resource AllocationStep 7 (Network): 80
4.8.1.8 Client Unable to Use Resources 80
4.8.2 Client Session Release Command Sequence 81
4.8.2.1 Client Initiates Release Request 81
4.8.2.2 Network Rejects Client Release Request 82
4.8.2.3 Server Rejects Server Release Indication 82
4.8.3 Client Initiated Status Command Sequence 82
4.9 Server Initiated Command Sequences 83
4.9.1 Server Continuous Feed Session Set-Up Command Sequence 83
4.9.1.1 Server Initiates Continuous Feed Session Set-Up 84

4.9.2 Server Add Resource Command Sequence 84
4.9.2.1 Server Initiates Add Resource Request 85
4.9.3 Server Session Delete Resource Command Sequence 86
4.9.4 Server Session Release Command Sequence 87
4.9.4.1 Server Initiates Release Request 87
4.9.4.2 Network Rejects Server Release Request 88
4.9.4.3 Client Rejects Client Release Indication 88
4.9.5 Server Continuous Feed Session Release Command Sequence 88
4.9.5.1 Server Initiates Continuous Feed Session Release Request 89
4.9.5.2 Network Rejects Server Release Request 90
4.9.5.3 Client Rejects Client Release Indication 90
4.9.6 Server Status Command Sequence 90
4.9.7 Server Session Forward Command Sequence 91
4.9.7.1 Client Initiates Session Set-Up 92
4.9.7.2 Network Rejects Forward 93
4.9.8 Server Session Transfer Command Sequence 93
4.9.8.1 Server A Initiates Session Transfer 94
4.9.8.2 Network Rejects Transfer Request 95
4.9.8.3 Server B Rejects the Transfer Request 95
4.9.8.4 Server B Unable to Allocate Resources for Transfer 96
4.9.8.5 Client Rejects Transfer 96
4.9.9 Transferred Session Release 96
4.9.9.1 SRM is Selecting sessionids 96
4.9.9.2 Server is Selecting sessionid 96
4.10 Network Initiated Command Sequences 97
4.10.1 Network Initiated Session Release Conunand Sequence 98
4.10.1.1 Network Initiates Session Release 98
4.10.2 Network Initiated Continuous Feed Session Release Command Sequence 98
4.10.2.1 Network Initiates Continuous Feed Session Release 99
4.10.3 Network Initiated Client Status Command Sequence 100
4.10.3.1 Network Initiates Client Status command sequence 100
4.10.4 Network Initiated Server Status Command Sequence 101
4.10.4.1 Network Initiates Server Status command sequence 101
4.11 Reset Procedures 101
4.11.1 Client Initiated Reset Command Sequence 1 02
4.11.1.1 Client Initiates Reset command sequence 102
4.11.2 Server Initiated Reset Command Sequence 102
4.11.2.1 Server Initiates Reset command sequence 103
4.11.3 Network Initiated Reset Command Sequence 103
4.11.3.1 Network Initiates Reset command sequence 103

5. USER-TO-USER INTERFACES 105
5.1 Introduction 105
5.1.1 Contents 105
5.1.2 Intended Usage 105
5.2 The User-to-User System Environment 107
5.2.1 U-U System Hardware User Entities 107
5.2.2 U-U System Logical Entities 107
5.2.3 Application and Service Interfaces 109
5.2.4 Categorization of Client Library Interface Sets 1 10
5.2.4.1 Consumer Client 1 10
5.2.4.2 Producer Client III
5.2.4.3 Client Library Profiles 1 1 1
5.2.5 Core Interfaces 112
5.2.5.1 Core Client Application Portability Library 113
5.2.5.2 Core Client Service Inter-operability Library 115
5.2.6 Extended Interfaces 116
5.2.6.1 Extended Client Application Portability Library 117
5.2.6.2 Extended Client Service-interoperability Library 1 1 8
5.3 Overview of the Interface Definition Language(IDL) 118
5.3.1 Operations 120
5.3.2 Attributes 121

5.3.3 Language Mapping 121
5.3.4 Encoding 121
5.3.5 Typographical Conventions 122
5.3.6 Syntactical Conventions 122
5.4 Common Definitions 122
5.4.1 Basic Types 122
5.4.2 Entity Identification 123
5.4.3 Interface Identification 124
5.4.4 Access Roles for Operations 126
5.4.4.1 Syntax for Access Control 1 26
5.4.5 Exceptions 127
5.4.6 Stream and Event Synchronization 1 30
5.5 Application Portability Interfaces(API) 131
5.5.1 Core Interfaces 131
5.5.1.1 Base 132
5.5.1.1.1 Summary of Base Primitives 1 32
5.5.1.1.2 DSM Base dose 133
5.5.1.1.3 DSM Base destroy 133
5.5.1.2 Access 133
5.5.1.2.1 Setting Permissions 134
5.5.1.2.2 Access Definitions 135
5.5.1.3 Stream 136
5.5.1.3.1 Stream Definitions, Exceptions 137
5.5.1.3.2 Normal Play Time Temporal Positioning 137
5.5.1.3.2.1 Application NPT Values 138
5.5.1.3.3 Summary of Stream Primitives 138
5.5.1.3.4 Stream State Machine 139
5.5.1.3.4.1 State Machine 139
5.5.1.3.4.2 Basic State Machine 141
5.5.1.3.4.3 Complete State machine 142
5.5.1.3.5 DSM Stream pause 143
5.5.1.3.6 DSM Stream resume 144
5.5.1.3.7 DSM Stream status 145
5.5.1.3.8 DSM Stream reset 146
5.5.1.3.9 DSM Stream jump 146
5.5.1.3.10 DSM Stream play 147
5.5.1.4 File 148
5.5.1.4.1 File Definitions, Exceptions 148
5.5.1.4.2 Summary of File Primitives 149
5.5.1.4.3 DSM File read 149
5.5.1.4.4 DSM File write 150
5.5.1.5 Directory 151
5.5.1.5.1 Directory Definitions, Exceptions 152
5.5. 1 5.2 Summary of Directory Primitives 154
5.5.1.5.3 DSM Directory list 155
5.5.1.5.4 DSM Directory resolve 156
5.5.1.5.5 DSM Directory bind 156
5.5.1.5.6 DSM Directory bind_context 157
5.5.1.5.7 rebind 158
5.5.1.5.8 DSM Directory rebind_context 158
5.5.1.5.9 DSM Directory unbind 159
5.5.1.5.10 DSM Directory new_context 160
5.5.1.5.11 DSM Directory bind_new_context 160
5.5.1.5.12 DSM Directory destroy 161
5.5.1.5.13 DSM Directory open 161
5.5.1.5.14 DSM Directory dose 162
5.5.1.5.15 DSM Directory get 163
5.5.1.5.16 DSM Directory put 164
5.5.1.6 Session 165
5.5.1.6.1 Service Transfer 165
5.5.1.6.2 Sununary of Session Primitives 166
5.5.1.6.3 DSM Session attach 166

5.5.1.6.4 DSM Session detach 167
5.5.1.7 ServiceGateway 168
5.5.1.7.1 Summary of ServiceGateway Primitives 168
5.5.1.8 First 168
5.5.1.8.1 Summary of First Primitives 168
5.5.1.8.2 DSM First root 169
5.5.1.8.3 DSM First Service 169
5.5.2 Extended Interfaces 169
5.5.2.1 Download 171
5.5.2.1.1 Download Definitions, Exceptions 171
5.5.2.1.2 Summary of Download Primitives 171
5.5.2.1.3 DSM Download info 171
5.5.2.1.4 DSM Download alloc 172
5.5.2.1.5 DSM Download Start 172
5.5.2.1.6 DSM Download cancel 173
5.5.2.2 Event 173
5.5.2.2.1 Event Definitions, Exceptions 174
5.5.2.2.2 Summary of Event Primitives 174
5.5.2.2.3 DSM Event subscribe 174
5.5.2.2.4 DSM Event unsubscribe 175
5.5.2.2.5 DSM Event notify 176
5.5.2.3 Composite 177
5.5.2.3.1 Summary of Composite Primitives 177
5.5.2.3.2 DSM Composite list_subs 177
5.5.2.3.3 DSM Composite bind_subs 178
5.5.2.3.4 DSM Composite unbind_subs 179
5.5.2.4 View 179
5.5.2.4.1 Non-Database View 180
5.5.2.4.2 DatabaseView 180
5.5.2.4.3 View Procedures 180
5.5.2.4.4 Definition: View Style Attribute 181
5.5.2.4.5 View Definitions: Statement, Result 182
5.5.2.4.6 Summary of View Primitives 182
5.5.2.4.7 DSM View query 183
5.5.2.4.8 DSM View read 184
5.5.2.4.9 DSM View execute 185
5.5.2.5 State 185
5.5.2.5.1 Summary of State Primitives 1 85
5.5.2.5.2 DSM State suspend 186
5.5.2.5.3 DSM State resume 187
5.5.2.6 Interfaces 187
5.5.2.6.1 TCKind Constants 188
5.5.2.6.2 Exception TCKind Constants 189
5.5.2.6.3 Interfaces Definitions 190
5.5.2.6.4 Summary of Interfaces Primitives 190
5.5.2.6.5 DSM Interfaces show 190
5.5.2.6.6 DSM Interfaces define 192
5.5.2.6.7 DSM Interfaces check 193
5.5.2.6.8 DSM Interfaces undefine 194
5.5.2.7 Security 194
5.5.2.7.1 DSM Security authenticate 194
5.5.2.8 Config 195
5.5.2.8.1 Config Definitions 197
5.5.2.8.2 Summary of Config Primitives 197
5.5.2.8.3 DSM Config inquire 197
5.5.2.8.4 DSM Config wait 197
5.5.2.9 LifeCycle 198
5.5.2.9.1 DSM LifeCycle create 198
5.5.2.10 Kind 199
5.5.2.10.1 Summary of Kind Primitives 1 99
5.5.2.10.2 DSM_Kind_has_a 199
5.5.2.10.3 DSM_Kind_is_a 200

5.5.3 C Language Mappings 201
5.5.3.1 Scoped Identifiers 201
5.5.3.2 C Mapping for Operations 201
5.5.3.2.1 C Mapping for Basic Data Types 202
5.5.3.2.2 Constants 202
5.5.3.2.3 Struct Types 202
5.5.3.2.4 Sequence Types 202
5.5.3.2.5 Strings 203
5.5.3.2.6 Any 203
5.5.3.2.7 ev 203
5.5.3.2.8 Object 203
5.5.3.3 API Definitions 204
5.5.3.3.1 C Mapping for the Synchronous Interface 204
5.5.3.3.1.1 Base 204
5.5.3.3.1.2 Access 204
5.5.3.3.1.3 Stream 205
5.5.3.3.1.4 File 206
5.5.3.3.1.5 Directory 206
5.5.3.3.1.6 Session 207
5.5.3.3.1.7 First 207
5.5.3.3.1.8 Event 208
5.5.3.3.1.9 Download 208
5.5.3.3.1.10 Composite 208
5.5.3.3.1.11 View 209
5.5.3.3.1.12 State 209
5.5.3.3.1.13 Interfaces 210
5.5.3.3.1.14 Security 210
5.5.3.3.1.15 LifeCycle 210
5.5.3.3.1.16 Kind 210
5.5.3.3.2 C Mapping for the Synchronous Deferred Interface 211
5.5.3.3.2.1 Config 211
5.5.3.3.2.2 How to Convert Synchronous to Synchronous Deferred 211
5.6 Service Interoperability Interfaces(SII) 211
5.6.1 ConnBinder and Resource to Connection Association 212
5.6.1.1 Selector 214
5.6.2 Remote Procedure Call 214
5.6.3 The Object Reference 214
5.6.3.1 Min Protocol Profile 215
5.6.3.2 Child Protocol Profile 216
5.6.3.3 Options Protocol Profile 216
5.6.3.4 Lite Protocol Profiles 217
5.6.3.5 BIOP Protocol Profile 217
5.6.3.6 ONC Protocol Profile 218
5.6.4 ServiceContextList 218
5.6.4.1 ServiceContext 219
5.6.5 Core Interfaces 220
5.6.5.1 Base 220
5.6.5.2 Access 220
5.6.5.3 Stream 222
5.6.5.3.1 Transport and Application Level NPT 224
5.6.5.3.2 Consistent Quantization Rules 224
5.6.5.4 File 224
5.6.5.5 BindingIterator 225
5.6.5.6 NamingContext 226
5.6.5.7 Directory 227
5.6.6 Extended Interfaces 229
5.6.6.1 SessionUU 229
5.6.6.1.1 PartialPath 230
5.6.6.2 ServiceGatewayUU 230
5.6.6.2.1 Summary of ServiceGatewayUU Primitives 230
5.6.6.3 SessionSI 231
5.6.6.4 ServiceGatewaySI 231

5.6.6.4.1 Summary of ServiceGatewaySI Primitives 232
5.6.6.5 DownloadSI 232
5.6.6.6 Event 235
5.6.6.7 Composite 236
5.6.6.8 View 238
5.6.6.9 State 240
5.6.6.10 Interfaces 241
5.7 Application Boot Process 241
5.7.1 Session attach() Pre-conditions 242
5.7.2 Session attach() Procedure 243
5.7.2.1 Resolving Path-specific Parameters 243
5.7.2.1.1 Post-condition 244
5.7.2.2 Establishing the U-N Session 244
5.7.2.2.1 ClientSessionSetupRequest 244
5.7.2.2.2 ClientSessionSetupConfirm 245
5.7.2.2.3 Session Establishment Post-conditions 246
5.7.2.3 Download 246
5.7.3 Session T ear-down 248
5.7.4 Session Transfer Implications 248

6. USER COMPATIBILITY 249
6.1 Compatibility Descriptors 249
6.1.1 IEEE OUI Specifier 25 1

7. USER-TO-NETWORK DOWNLOAD 252
7.1 Overview 252
7.1.1 Download Network Models 253
7.1.2 Preconditions and Assumptions 254
7.2 Download Message Set 255
7.2.1 Download Control Message Format 255
7.2.2 Download Data Message Format 255
7.2.2.1 DSM-CC Download Data Header 255
7.3 Message Descriptions 256
7.3.1 DownloadInfoRequest 257
7.3.2 DownloadInfoResponse and DownloadInfoIndication 257
7.3.3 DownloadDataBlock 259
7.3.4 DownloadDataRequest 259
7.3.5 DownloadCancel 260
7.3.6 DownloadServerInitiate 263
7.4 Message Sequence for Flow-Controlled Download Scenario 263
7.4.1 Getting Download Protocol Parameters 264
7.4.2 Starting Download 265
7.4.3 Acknowledgments 265
7.4.4 Timers and Re-transmission 266
7.4.5 Abort 267
7.4.6 Flow-Controlled Scenario over Reliable Transport 267
7.5 Message Sequence for Data Carousel Scenario 267
7.5.1 Getting Data Carousel Parameters 267
7.5.2 Starting Acquisition and Module Re-Assembly 268
7.5.2.1 Pseudo-Code Example of Module Re-assembly 268
7.5.3 Timers 269
7.5.4 Module Coherency 270
7.5.5 Data Delivery Rate 270
7.6 Message Sequence for Non-Flow-Controlled Download Scenario 270
7.6.1 Getting Download Protocol Parameters 27 1
7.6.2 Image Assembly and Coherency 27 1
7.6.3 Timers 271
7.7 Protocol State Machines for flow-controlled download scenario 27 1
7.7.1 State Variables common to Client and Download Server 272
7.7.1.1 Service Type: reliableService, unreliableService 272
7.7.1.2 Download configured bufferSize: bufferSize 272
7.7.1.3 Download configured maximumBlockSize: blockSize 272

7.7.1.4 Download Identifier: Did 272
7.7.1.5 Download negotiated blockSize; Did.blockSize 272
7.7.1.6 Download negotiated windowSize: Did. windowSize 272
7.7.1.7 Download negotiated Acknowledgment Period: Did.ackPeriod 272
7.7.1.8 Download negotiated Window Timer; Did.tWindow 272
7.7.1.9 Download negotiated Scenario Timer; Did.tScenario 272
7.7.1.10 Download negotiated compatibilities; Did.compatibilities 272
7.7.1.11 Download Number of Modules: Did.numModules 272
7.7.1.12 Download Module Identifier: Did.moduleId 272
7.7.1.13 Download Module Version; Did.moduleId.version 273
7.7.1.14 Download Module Size; Did.moduleId.moduleSize 273
7.7.1.15 Download Expired downloadid Holding timer; Did.tHold 273
7.7.2 Client-only State Variables 273
7.7.2.1 Download Lower Receive Window Edge; Did.NmoduleId, Did.NblockNum 273
7.7.2.2 Number received blocks; Did.Nblock 273
7.7.2.3 Acknowledgment threshold: Did.AckThreshold 273
7.7.3 Server-only State Variables 273
7.7.3.1 Lower Transmit Window Edge: Did.LmoduleId, Did.LblockNum 273
7.7.3.2 Upper Transmit Window Edge: Did.UmoduleId, Did.UblockNum 273
7.7.3.3 Data Sending Rate Timer: Did.tSend 273
7.7.4 Client Conditions 273
7.7.4.1 Invalid ServerId 273
7.7.4.2 Number of re-transmission exceeded 274
7.7.4.3 Unacceptable blockSize 274
7.7.4.4 Unacceptable WindowSize 274
7.7.4.5 Unacceptable Acknowledgment Period 274
7.7.4.6 Unacceptable Window Timer 274
7.7.4.7 Unacceptable Scenario Timer 274
7.7.4.8 Unacceptable Compatibilities 274
7.7.4.9 Unacceptable Module Table 274
7.7.4.10 Acknowledgment period füll 274
7.7.4. 11 Download complete 274
7.7.5 Download Server Conditions 274
7.7.5.1 Unacceptable maximumBlockSize 274
7.7.5.2 Unacceptable bufferSize 275
7.7.5.3 Unacceptable Compatibilities 275
7.7.6 Client Procedures 275
7.7.6.1 Initial Setup of State Variables 275
7.7.6.2 Sending DownloadDataRequest Messages 275
7.7.6.3 Sending DownloadCancel Messages 275
7.7.6.4 Increment Lower Receive Window Edge 275
7.7.6.5 Increment block counter 276
7.7.6.6 Transition to DCExpire State 276
7.7.7 Download Server Procedures 276
7.7.7.1 Initial Setup of State Variables 276
7.7.7.2 Increment Lower Transmit Window Edge 277
7.7.7.3 Set Upper Transmit Window Edge 277
7.7.7.4 Sending DownloadDataBlock Messages 277
7.7.7.5 Sending DownloadCancel Messages 277
7.7.7.6 Transition to DSExpire State 277
7.7.8 State Machine SDL 277
7.8 Partial Protocol State Machines for non-flow-controlled download scenario 277

8. STREAM DESCRIPTORS 279
8.1 Normal Play Time 279
8.1.1 NPT Reference Descriptor 279
8.1.2 Reconstruction of NPT 280
8.1.3 NPT Conversion to Seconds and Microseconds 281
8.1.4 NPT Uncertainty 281
8.1.4.1 Frequency of NPT Reference Descriptor 28 1
8.1.5 NPT Endpoint Descriptor 282
8.2 Stream Mode Descriptor 282

8.3 Stream Event Descriptor 283

9. TRANSPORT 284
9.1 DSM-CC Requirements on Lower-Level Network Transport Protocol 284
9.1.1 U-N Message Categories 284
9.1.2 U-U Interface Categories 284
9.2 Encapsulation within MPEG-2 Transport Streams 285
9.2.1 Role of MPEG-2 Transport Stream in the Protocol Stack 285
9.2.2 DSM-CC Sections 285
9.2.2.1 Semantic definition of fields in DSMCC_section 286
9.2.3 DSM-CC Stream Types 288
9.2.4 DSM-CC Multi-protocol Encapsulation 288
9.2.5 U-N Message Categories 289
9.2.6 U-U Service Inter-operability Interface using Remote Procedure Call 289
9.2.7 DSM-CC Stream Descriptors 289
9.2.7.1 Semantic definition of fields in DSM-CC Descriptor List 289
9.3 Encapsulation within MPEG-2 Program Streams 289
9.3.1 DSM-CC Stream Descriptors 289
9.3.1.1 Semantic definition of fields in DSM-CC_program_stream_Descriptor List 290
9.3.2 U-N Messages and U-U SSI 290

10. U-N SWITCHED DIGITAL BROADCAST - CHANNEL CHANGE PROTOCOL 291
10.1 Overview 291
10.1.1 Preconditions and Assumptions 291
10.1.2 General Message Format 29 1
10.2 Switched Digital Broadcast Channel Change Protocol Messages 29 1
10.2.1 Use of Private Data in SDB CCP messages 292
10.2.2 Use of BroadcastProgramId in SDB CCP messages 292
10.2.3 SDB CCP message definitions 292
10.2.3.1 SDBProgramSelectRequest message definition 293
10.2.3.2 SDBProgramSelectConfirm message definition 293
10.2.3.3 SDBProgramSelectIndication message definition 294
10.2.3.4 SDBProgramSelectResponse message definition 294
10.3 SDB Channel Change Protocol Command Scenarios 294
10.3.1 Client Initiated Program Select Command Sequence 294
10.3.2 SDB Server Initiated Program Select Command Sequence 296
10.4 SDB Reason and Response Codes 297
10.4.1 SDB Reason Codes 297
10.4.2 SDB Response Codes 298
10.5 SDB State Machine 298
10.5.1 SDB State Machine for the Client Side 298
10.5.2 State machine for the SDB Server Side 300

11. U-U OBJECT CAROUSEL 303
11.1 Introduction 303
11.2 Concepts 304
11.2.1 Supported U-U Objects and Interfaces 304
11.2.2 Service Domain and Service Gateway 304
11.2.3 Object References 305
11.2.4 Transport of BIOP Messages 305
11.2.5 Module Delivery Parameters 306
11.2.6 Taps 306
11.3 Broadcast Inter ORB Protocol 307
11.3.1 Inter-operable Object Reference (IOR) 307
11.3.1.1 Profile Body Definition 307
11.3.1.1.1 Object Location Component 307
11.3.1.1.2 ConnBinder Component 307
11.3.2 Message Set Definition 308
11.3.2.1 Generic Object Message Format 308
11.3.2.2 Directory Message Format 310
11.3.2.3 File Message Format 311
11.3.2.4 Stream Message Format 311

11.3.2.5 Service Gateway Message Format 313
11.3.3 Transport Definitions 313
11.3.3.1 BIOP Messages 313
11.3.3.2 Module Delivery Parameters 313
11.3.3.3 IOR of Service Gateway 314
11.4 MPEG-2 Descriptors 315
11.4.1 Carousel identifier descriptor 316
11.4.2 Association tag descriptor 316
11.4.3 Deferred association tags descriptor 318

12. USER-TO-NETWORK PASS-THRU MESSAGES 319
12.1 Overview and the General Message Format 319
12.2 Pass-Thru Messages 319
12.2.1 Use of PassThruData() structure in Pass-Thru messages 320
12.2.2 Pass-Thru message definitions 321
12.2.2.1 PassThruRequest 321
12.2.2.2 PassThruIndication 321
12.2.2.3 PassThruReceiptRequest 321
12.2.2.4 PassThruReceiptConfirm 322
12.2.2.5 PassThruReceiptIndication 322
12.2.2.6 PassThruReceiptResponse 323
12.3 User-to-Network Pass-Thru Message Field Data Types 323
12.4 Pass-Thru Message Scenario 324
12.4.1 Pass-Thru Message scenario 324
12.4.1.1 The Sending User sends a PassThruRequest 324
12.5 Pass-Thru Receipt Message Scenario 324
12.5.1 Pass-Thru Receipt Message scenario 325
12.5.1.1 The Sending User sends a PassThruReceiptRequest 325
12.6 Pass-Thru Response Codes 326
12.7 Pass-Thru Type Codes 326
12.8 State Machine 326

ANNEX A (NORMATIVE) USER-NETWORK PROTOCOL STATE MACHINES 327
A.I Introduction 327
A.2 U-N Session 327
A.3 U-N Download Flow Controlled Scenario 364
A.4 U-N Switched Digital Broadcast Channel Change Protocol 377
A.5 U-N Pass-Thru 390

ANNEX B (INFORMATIVE) APPLICATION EXAMPLES 399
B.1 Introduction 399
B.2 Video Stream Play 399
B.3 Building a Directory Hierarchy 40 1
B.4 Movie Information Database 402
B.5 View as a Personalized Directory 408

ANNEX C (INFORMATIVE) ONC RPC XDR MAPPINGS 410
C.I Overview 410
C.2 General RPC Message Formats 410
C.3 CORBA IDL C to XDR Mapping 412
C.3.1 Mapping for Integer Data Types 412
C.3.2 Mapping for void 412
C.3.3 Mapping for Constants 413
C.3.4 Mapping for octet 413
C.3.5 Mapping for Fixed-length Constructed Types 413
C.3.5.1 Mapping for struct 413
C.3.6 Mapping for sequences 413
C.3.6.1 Example; Mapping for opaque 413
C.3.6.2 Example: Mapping for PathSpec 414
C.3.7 Mapping for string 415
C.4 DSM-CC ONC Protocol Profile for the Interoperable Object Reference 415
C.5 Exceptions C.6 Request and Reply Header Structures 417

C.7 DSM-CC RPC Program Numbers 418
C.7.1 RPC Program Dispatch Tables Mapping 418

ANNEX D (INFORMATIVE) USING DSM-CC U-N SESSION MESSAGES WITH ATM 421
D. 1 Methods of using DSM-CC over ATM 42 1
D.1.1 SessionMethod 421
D. 1.2 Network Method with AddResource messages between the Server and the SRM 42 1
D. 1.3 Network Method with NO AddResource messages between the Server and the SRM 42 1
D. 1.4 Integrated Method 422
D.2 Association of DSM-CC connection resources to ATM SVCs 423
D.2.1 DSM-CC resourceId Mapping into Q.293 1 423
D.3 Session Method Command Sequences 424
D.3.1 Session Set-Up 424
D.3.1.1 Client Session Set-Up 425
D.3.2 Add Resource Request 428
D.3.2.1 Add Resource Request by the Server 429
D.3.3 Resource Deletion 430
D.3.3.1 Resource Deletion by the Server 43 1
D.3.4 Session Tear-Down 433
D.3.4.1 Session Tear-Down by Server 434
D.3.4.2 Session Tear-Down by Client 436
D.4 Network Method with DSM-CC AddResource messages between the Server and SRM 437
D.4.1 Session Set-Up 437
D.4. 1 1 Client Session Set-Up, Server ATM Connection Set-Up 437
D.4.2 Add Resource Request 440
D.4.2.1 Add Resource Request by Server and ATM SVC Connection Set-Up by Server 440
D.4.3 Resource Deletion 442
D.4.3.1 Resource Deletion Request by Server and ATM SVC Connection Release by Server 442
D.4.4 Session Tear-Down 443
D.4.4.1 Session Tear-Down Request by Server and ATM SVC Connection Release by Client 443
D.4.4.2 Session Tear-Down Request by Client and ATM SVC Connection Release by Server 444
D.4.4.3 Session Tear-Down Request by Server and ATM SVC Connection Release by Server 445
D.5 Network Method with NO DSM-CC AddResource messages between the Server and SRM 446
D.5 1 Session Set-Up 446
D.5. 1 1 Client Session Set-Up 447
D.5.2 Add Resource Request 447
D.5.2.1 Add Resource Request by the Server 447
D.5.3 Connection Clearing 449
D.5.3.1 Connection Clearing by the Server 449
D.5.3.2 Connection Clearing by the Client 451
D.5.4 Session Tear-Down 45 1
D.5.4.1 Session Tear-Down by Server 451
D.5.4.2 Session Tear-Down by Client 452
D.6 Integrated Method Command Sequences 453
D.6.1 Session Set-Up 454
D.6. 1 1 Client Session Set-Up 454
D.6. 1.2 Server Session Set-Up 455
D.6.2 Integrated Method for Adding Resources 455
D.6.3 Connection Clearing 45 6
D.6.4 Session Tear-Down 456
D.6.4.1 Server Session Tear-Down 457
D.6.4.2 Client Session Tear Down 457
D.7 References 457

ANNEXE (INFORMATIVE) UNO INTER-OPERABLE RPC PROTOCOL STACK 459
E.I Abstract 459
E.2 Motivation 459
E.3 Solution Space 459
E.4 Inter-operation Framework 460
E.5 Protocol Selection 461
E.6 Common Data Representation 46 1
E.6.1 Encapsulation 462

E.6.2 Alignment....462
E.6.3 Primitive Data Types....462
E.6.4 Compound Types....463
E.6.5 TypeCode....463
E.7 UNO Session Protocol....464
E.7 1 Message Set....464
E.7.1.1 Request Message....464
E.7.1.2 Reply....465
E.7.1.3 CancelRequest....466
E.7. 1.4 LocateRequest....466
E.7.1.5 LocateReply....466
E.7.1.6 CloseConnection....466
E.7.1.7 MessageError....466
E.7.2 Session Semantics....466
E.8 Transport and Network Semantics....467

ANNEXE (INFORMATIVE) USE OF U-U OBJECT CAROUSEL....468
F.1 Introduction....468
F.2 Purpose of U-U Object Carousels....468
F.3 IDL structures....468
F.3.1 Inter-operable object Reference....468
F.3.2 Generic object Message....470
F.3.3 Directory Message....470
F.4 Support for New Object Representations 47....1
F.5 How to resolve an object from its IOR....472
F.6 Service Gateway and Download Support....474
F.7 U-U Object Carousels on top of MPEG-2 TS Broadcast Networks....475

ANNEX G (INFORMATIVE) SHARED RESOURCES AND THE ASSOCIATION TAG....477
G.I Introduction....477
G.2 Use of the Association Tag....477
G.3 Use of the SharedResource Descriptor....478
G.4 Use of the SharedRequestId Descriptor....478
G.5 Common Examples of Use -479
G.5.1 Download Phase, Multiple ATM SVCs....479
G.5.1.1 End-to-End ATM....479
G.5.1.2 Non-ATM HFC Client View....480
G.5.2 Video Play Phase, Multiple ATM SVCs....481
G.5.2.1 End-to-End ATM....481
G.5.2.2 Non-ATM HFC Client View....482
G.5.3 Single Asymmetrie ATM SVC....483
G.5.3.1 End-to-End ATM....483
G.5.3.2 Non-ATM HFC Client View....484
G.5.4 Single Asymmetrie ATM PVC....486
G.5.5 Download Phase, Multiple ATM PVCs....486
G.5.6 Video Play Phase, Multiple ATM PVCs....486
G.5.7 Use of sharedResourceRequest Descriptors....486

ANNEX H (INFORMATIVE) SWITCHED DIGITAL BROADCAST SERVICE....487
H.1 Introduction....487
H.2 Switched Digital Broadcast Service....487
H.3 Functional Flows....488
H.3 1 Broadcast Program Configuration....488
H.3.2 Client Service Profile Transfer to the SDB Server....489
H.3.3 Broadcast Program Guide Transfer to Client....490
H.3.4 Switched Digital Broadcast Service Session Establishment....490
H.3.5 Client Initiated Channel Changes....492
H.3.6 Network Initiated Channel Changes....493
H.3.7 Digital Broadcast Session Release....495

ANNEX I (INFORMATIVE) EXAMPLE U-N LIFE CYCLE WALK THROUGH....497
I.1 Introduction....497

I.2 General Flow 497
I.3 U-N-Configuration 498
I.3.1 Pre Conditions 498
I.3.2 Procedure 498
I.3.3 Post Conditions 49 8
I.4 U-N Session Setup 499
I.4.1 Pre Conditions 499
I.4.2 Procedure 499
I.4.3 Post Conditions 502
I.5 U-N Download 503
I.5.1 Pre Conditions 503
I.5.2 Procedure 504
I.5.3 Post Conditions 504

ANNEX J (INFORMATIVE) EXAMPLE OF AN OSI NSAP ADDRESS FORMAT 505
J.I Purpose 505
J.2 Introduction 505
J.3 E. 164 NSAP 505

ANNEX K (INFORMATIVE) STREAM PLAYLIST 507
K.1 Overview 507
K.2 DSM QStream next 509

ANNEX L (INFORMATIVE) SERVICE TRANSFER MESSAGE FLOWS 510
L.1 Introduction 510
L.1.1 Use of Service transfer in the normal course of Service 510
L.1.2 Use of Service Transfer in emergency cases 511
L.2 Basic application level Service Transfer 511
L.2.1 Service Transfer: sourceServer to destinationServer with sourceServer Session Release 511
L.2.2 Service Transfer: sourceServer to destinationServer, Service maintained on sourceServer 5 .. 12
L.3 Enhanced application level Service Transfer 513
L.3.1 Release the Session with the sourceServer 513
L.3.2 Maintain minimum resources with the sourceServer 5 14
L.3.3 Maintain the Service with the sourceServer 515
L.3.4 Fall back to Server A after Session release with the sourceServer 515
L.3.5 Resumption of the füll context on Server A after reduced Session 515
L.3.6 Emergency Service Transfer 516

ANNEX M (INFORMATIVE) T.120 INTER-WORKING 519
M.1 Introduction 519
M.2 Reference Model for side-by-side integrated DSM-CC/T. 120 5 19
M.3 Features, Functions and Services of the DSM-CC and the T.120 specifications 521
M.3.1 Features, Functions and Services of DSM-CC 521
M.3.2 Features, Functions and Services of T.120 521
M.3.3 Inter-working of DSM-CC and T. 120 Features, Functions and Services 521
M.4 DSM-CC and T. 120 Components Harmonized 522
M.5 Specifics for inter-operation between DSM-CC and T. 120 523
M.5.1 Terminal 1 creates a conference 524
M.5.2 Terminal 2 queries a conference 524
M.5.3 Terminal 2 joins the conference 524
M.6 T. 120 Service within DSM-CC 536
M.6.1 An Example of Extending DSM-UU to provide custom interfaces 536

ANNEX N (INFORMATIVE) THE RELATION OF DSM-CC TO MHEG-5 539
N.1 Overview 539
N.2 Name Space 539
N.2.1 MHEG Object References 540
N.2.2 Content References 540
N.3 Stream Events and Normal Play Time 540
N.4 Example of DSM-CC file structure for an application 541
N.5 Example of Mapping High-Level API Actions on DSM-CC U-U Primitives 542