INTERNATIONAL STANDARD

ISO/IEC 14496-1

First edition
1999-12-15

Information technology — Coding of audio-visual objects —

Part 1: Systems

Technologies de l'information — Codage des objets audiovisuels — Partie 1: Systèmes

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

Reference number
ISO/IEC 14496-1:1999(E)

© ISO/IEC 1999

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 734 10 79
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

© ISO/IEC 1999 – All rights reserved

Contents

Page

0 Introduction xix

0.1 Overview xix

0.2 Architecture xix

0.3 Terminal Model: Systems Decoder Model xxi

0.3.1 Timing Model xxi

0.3.2 Buffer Model xxi

0.4 Multiplexing of Streams: The Delivery Layer xxi

0.5 Synchronization of Streams: The Sync Layer xxi

0.6 The Compression Layer xxii

0.6.1 Object Description Framework xxii

0.6.2 Scene Description Streams xxii

0.6.3 Audio-visual Streams xxiii

0.6.4 Upchannel Streams xxiii

1 Scope 1

2 Normative References 1

3 Additional References 2

4 Definitions 2

5 Abbreviations and Symbols 6

6 Conventions 7

7 Systems Decoder Model 7

7.1 Introduction 7

7.2 Concepts of the Systems Decoder Model 7

7.2.1 DMIF Application Interface (DAI) 7

7.2.2 SL-Packetized Stream (SPS) 8

7.2.3 Access Units (AU) 8

7.2.4 Decoding Buffer (DB) 8

7.2.5 Elementary Streams (ES) 8

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

7.2.6 Elementary Stream Interface (ESI) 8
7.2.7 Decoder 8
7.2.8 Composition Units (CU) 8
7.2.9 Composition Memory (CM) 8
7.2.10 Compositor 9
7.3 Timing Model Specification 9
7.3.1 System Time Base (STB) 9
7.3.2 Object Time Base (OTB) 9
7.3.3 Object Clock Reference (OCR) 9
7.3.4 Decoding Time Stamp (DTS) 9
7.3.5 Composition Time Stamp (CTS) 10
7.3.6 Occurrence and Precision of Timing Information in Elementary Streams 10
7.3.7 Time Stamps for Dependent Elementary Streams 10
7.4 Buffer Model Specification 11
7.4.1 Elementary Decoder Model 11
7.4.2 Assumptions 11
7.4.3 Managing Buffers: A Walkthrough 12
8 Object Description Framework 13
8.1 Introduction 13
8.2 Common data structures 14
8.2.1 Overview 14
8.2.2 BaseDescriptor 15
8.2.3 BaseCommand 16
8.3 Intellectual Property Management and Protection (IPMP) 16
8.3.1 Overview 16
8.3.2 IPMP Streams 17
8.4 Object Content Information (OCI) 18
8.4.1 Overview 18
8.4.2 OCI Streams 18
8.5 Object Descriptor Stream 19

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-b0f7f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

8.5.1 Structure of the Object Descriptor Stream 19
8.5.2 Access Unit Definition 19
8.5.3 Time Base for Object Descriptor Streams 20
8.5.4 OD Decoder Configuration 20
8.5.5 OD Command Syntax and Semantics 20
8.6 Object Descriptor Components 22
8.6.1 Overview 22
8.6.2 ObjectDescriptor 22
8.6.3 InitialObjectDescriptor 23
8.6.4 ES_Descriptor 26
8.6.5 DecoderConfigDescriptor 28
8.6.6 DecoderSpecificInfo 29
8.6.7 SLConfigDescriptor 30
8.6.8 IP_IdentificationDataSet 30
8.6.9 ContentIdentificationDescriptor 30
8.6.10 SupplementaryContentIdentificationDescriptor 32
8.6.11 IPI_DescrPointer 32
8.6.12 IPMP_DescriptorPointer 33
8.6.13 IPMP Descriptor 33
8.6.14 QoS_Descriptor 34
8.6.15 ExtensionDescriptor 35
8.6.16 RegistrationDescriptor 35
8.6.17 Object Content Information Descriptors 36
8.7 Rules for Usage of the Object Description Framework 41
8.7.1 Aggregation of Elementary Stream Descriptors in a Single Object Descriptor 41
8.7.2 Linking Scene Description and Object Descriptors 43
8.7.3 ISO/IEC 14496 Content Access 44
8.8 Usage of the IPMP System interface 50
8.8.1 Overview 50
8.8.2 Association of an IPMP System with IS0/IEC 14496 content 50

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

8.8.3 IPMP of Object Descriptor streams 51
8.8.4 IPMP of Scene Description streams 51
8.8.5 Usage of URLs in managed and protected content 51
8.8.6 IPMP Decoding Process 52
9 Scene Description 53
9.1 Introduction 53
9.1.1 Scope 53
9.1.2 Composition and Rendering 54
9.1.3 Scene Description 54
9.2 Concepts 55
9.2.1 BIFS Elementary Streams 55
9.2.2 BIFS Scene Graph 57
9.2.3 Sources of modification to the scene 64
9.3 BIFS Syntax 67
9.3.1 Introduction 67
9.3.2 Decoding tables, data structures and associated functions 68
9.3.3 Quantization 73
9.3.4 Compensation process 82
9.3.5 BIFS Configuration 83
9.3.6 BIFS Command Syntax 87
9.3.7 BIFS Scene 94
9.3.8 BIFS-Anim 115
9.4 Node Semantics 121
9.4.1 Overview 121
9.4.2 Node specifications 121
10 Synchronization of Elementary Streams 192
10.1 Introduction 192
10.2 Sync Layer 192
10.2.1 Overview 192
10.2.2 SL Packet Specification 193

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

10.2.3 SL Packet Header Configuration 193
10.2.4 SL Packet Header Specification 196
10.2.5 Clock Reference Stream 199
10.2.6 Restrictions for elementary streams sharing the same object time base 199
10.2.7 Usage of configuration options for object clock reference and time stamp values 200
10.3 Elementary Stream Interface (Informative) 201
10.4 DMIF Application Interface 203
11 Multiplexing of Elementary Streams 203
11.1 Introduction 203
11.2 FlexMux Tool 203
11.2.1 Overview 203
11.2.2 Simple Mode 203
11.2.3 MuxCode mode 204
11.2.4 FlexMux packet specification 204
11.2.5 Usage of MuxCode Mode 206
12 Syntactic Description Language 207
12.1 Introduction 207
12.2 Elementary Data Types 207
12.2.1 Constant-Length Direct Representation Bit Fields 207
12.2.2 Variable Length Direct Representation Bit Fields 208
12.2.3 Constant-Length Indirect Representation Bit Fields 208
12.2.4 Variable Length Indirect Representation Bit Fields 209
12.3 Composite Data Types 210
12.3.1 Classes 210
12.3.2 Abstract Classes 211
12.3.3 Expandable classes 211
12.3.4 Parameter types 212
12.3.5 Arrays 212
12.3.6 Partial Arrays 213
12.3.7 Implicit Arrays 213

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

12.4 Arithmetic and Logical Expressions 214
12.5 Non-Parsable Variables 214
12.6 Syntactic Flow Control 214
12.7 Built-In Operators 216
12.8 Scoping Rules 216
13 Profiles 216
13.1 Introduction 216
13.2 OD Profile Definitions 216
13.2.1 Overview 216
13.2.2 OD Profiles Tools 216
13.2.3 OD Profiles 217
13.2.4 OD Profiles@Levels 217
13.3 Scene Graph Profile Definitions 217
13.3.1 Overview 217
13.3.2 Scene Graph Profiles Tools 217
13.3.3 Scene Graph Profiles 217
13.3.4 Scene Graph Profiles@Levels 220
13.4 Graphics Profile Definitions 221
13.4.1 Overview 221
13.4.2 Graphics Profiles Tools 221
13.4.3 Graphics Profiles 221
13.4.4 Graphics Profiles@Levels 222
Annex A (informative) Bibliography 225
Annex B (informative) Time Base Reconstruction 226
B.1 Time Base Reconstruction 226
B.1.1 Adjusting the Receiving Terminal's OTB 226
B.1.2 Mapping Time Stamps to the STB 226
B.1.3 Adjusting the STB to an OTB 227
B.1.4 System Operation without Object Time Base 227
B.2 Temporal aliasing and audio resampling 227

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-7770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

B.3 Reconstruction of a Synchronised Audio-visual Scene: A Walkthrough 227

Annex C (normative) **View Dependent Object Scalability 229**

C.1 Introduction 229

C.2 Bitstream Syntax 229

C.2.1 View Dependent Object 229

C.3 Bitstream Semantics 230

C.3.1 View Dependent Object 230

C.3.2 View Dependent Object Layer 230

Annex D (informative) **Registration procedure 232**

D.1 Procedure for the request of a Registration ID (RID) 232

D.2 Responsibilities of the Registration Authority 232

D.3 Contact information for the Registration Authority 232

D.4 Responsibilities of Parties Requesting a RID 232

D.5 Appeal Procedure for Denied Applications 233

D.6 Registration Application Form 233

D.6.1 Contact Information of organization requesting a RID 233

D.6.2 Request for a specific RID 233

D.6.3 Short description of RID that is in use and date system was implemented 233

D.6.4 Statement of an intention to apply the assigned RID 233

D.6.5 Date of intended implementation of the RID 234

D.6.6 Authorized representative 234

D.6.7 For official use of the Registration Authority 234

Annex E (informative) **The QoS Management Model for ISO/IEC 14496 Content 235**

Annex F (informative) **Conversion Between Time and Date Conventions 236**

Annex G (normative) **Adaptive Arithmetic Decoder for BIFS-Anim 238**

Annex H (normative) **Node coding tables 240**

H.1 Node Tables 240

H.1.1 Anchor 240

H.1.2 AnimationStream 240

H.1.3 Appearance 241

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-1777f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

H.1.4 AudioBuffer 241
H.1.5 AudioClip 241
H.1.6 AudioDelay 241
H.1.7 AudioFX 241
H.1.8 AudioMix 242
H.1.9 AudioSource 242
H.1.10 AudioSwitch 242
H.1.11 Background 242
H.1.12 Background2D 243
H.1.13 Billboard 243
H.1.14 Bitmap 243
H.1.15 Box 243
H.1.16 Circle 243
H.1.17 Collision 243
H.1.18 Color 244
H.1.19 ColorInterpolator 244
H.1.20 CompositeTexture2D 244
H.1.21 CompositeTexture3D 244
H.1.22 Conditional 244
H.1.23 Cone 245
H.1.24 Coordinate 245
H.1.25 Coordinate2D 245
H.1.26 CoordinateInterpolator 245
H.1.27 CoordinateInterpolator2D 245
H.1.28 Curve2D 245
H.1.29 Cylinder 246
H.1.30 CylinderSensor 246
H.1.31 DirectionalLight 246
H.1.32 DiscSensor 246
H.1.33 ElevationGrid 247

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

H.1.34 Expression 247
H.1.35 Extrusion 247
H.1.36 Face 248
H.1.37 FaceDefMesh 248
H.1.38 FaceDefTables 248
H.1.39 FaceDefTransform 248
H.1.40 FAP 248
H.1.41 FDP 250
H.1.42 FIT 250
H.1.43 Fog 250
H.1.44 FontStyle 250
H.1.45 Form 251
H.1.46 Group 251
H.1.47 ImageTexture 251
H.1.48 IndexedFaceSet 251
H.1.49 IndexedFaceSet2D 252
H.1.50 IndexedLineSet 252
H.1.51 IndexedLineSet2D 252
H.1.52 Inline 252
H.1.53 LOD 253
H.1.54 Layer2D 253
H.1.55 Layer3D 253
H.1.56 Layout 253
H.1.57 LineProperties 254
H.1.58 ListeningPoint 254
H.1.59 Material 254
H.1.60 Material2D 254
H.1.61 MovieTexture 254
H.1.62 NavigationInfo 255
H.1.63 Normal 255

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

H.1.64 NormalInterpolator 255
H.1.65 OrderedGroup 255
H.1.66 OrientationInterpolator 255
H.1.67 PixelTexture 255
H.1.68 PlaneSensor 256
H.1.69 PlaneSensor2D 256
H.1.70 PointLight 256
H.1.71 PointSet 256
H.1.72 PointSet2D 256
H.1.73 PositionInterpolator 257
H.1.74 PositionInterpolator2D 257
H.1.75 ProximitySensor2D 257
H.1.76 ProximitySensor 257
H.1.77 QuantizationParameter 257
H.1.78 Rectangle 258
H.1.79 ScalarInterpolator 258
H.1.80 Script 259
H.1.81 Shape 259
H.1.82 Sound 259
H.1.83 Sound2D 259
H.1.84 Sphere 259
H.1.85 SphereSensor 259
H.1.86 SpotLight 260
H.1.87 Switch 260
H.1.88 TermCap 260
H.1.89 Text 260
H.1.90 TextureCoordinate 260
H.1.91 TextureTransform 261
H.1.92 TimeSensor 261
H.1.93 TouchSensor 261

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

H.1.94 Transform 261
H.1.95 Transform2D 261
H.1.96 Valuator 262
H.1.97 Viewpoint 263
H.1.98 VisibilitySensor 263
H.1.99 Viseme 263
H.1.100 WorldInfo 263
H.2 Node Definition Type Tables 263
H.2.1 SF2DNode 263
H.2.2 SF3DNode 264
H.2.3 SFAppearanceNode 265
H.2.4 SFAudioNode 265
H.2.5 SFBackground2DNode 265
H.2.6 SFBackground3DNode 265
H.2.7 SFColorNode 266
H.2.8 SFCoordinate2DNode 266
H.2.9 SFCoordinateNode 266
H.2.10 SFExpressionNode 266
H.2.11 SFFAPNode 266
H.2.12 SFFDPNode 266
H.2.13 SFFITNode 266
H.2.14 SFFaceDefMeshNode 266
H.2.15 SFFaceDefTablesNode 266
H.2.16 SFFaceDefTransformNode 266
H.2.17 SFFogNode 267
H.2.18 SFFontStyleNode 267
H.2.19 SFGeometryNode 267
H.2.20 SFLinePropertiesNode 267
H.2.21 SFMaterialNode 267
H.2.22 SFNavigationInfoNode 267

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

© ISO/IEC 1999 – All rights reserved

H.2.23 SFNormalNode 267

H.2.24 SFStreamingNode 268

H.2.25 SFTextureCoordinateNode 268

H.2.26 SFTextureNode 268

H.2.27 SFTextureTransformNode 268

H.2.28 SFTopNode 268

H.2.29 SFViewpointNode 268

H.2.30 SFVisemeNode 268

H.2.31 SFWorldNode 268

Annex I (informative) **MPEG-4 Audio TTS application with Facial Animation 271**

Annex J (informative) **Graphical representation of object descriptor and sync layer syntax 272**

J.1 Length encoding of descriptors and commands 272

J.2 Object Descriptor Stream and OD commands 272

J.3 IPMP stream 273

J.4 OCI stream 273

J.5 Object descriptor and its components 273

J.6 OCI Descriptors 275

J.7 Sync layer configuration and syntax 278

Annex K (informative) **Patent statements 280**

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

Figures

Figure 1 - The ISO/IEC 14496 terminal architecture xx

Figure 2 - Systems Decoder Model 7

Figure 3 - Composition unit availability 10

Figure 4 - Flow diagram for the Systems Decoder Model 11

Figure 5 - Object descriptors linking scene description to elementary streams 14

Figure 6 - Complex content example 48

Figure 7 - Requesting stream delivery through the DAI 50

Figure 8 - IPMP system in the ISO/IEC 14496 terminal architecture 52

© ISO/IEC 1999 – All rights reserved

Figure 9 - An example of an object-based multimedia scene **53**

Figure 10 - Logical structure of example scene **54**

Figure 11 - Media start times and CTS **57**

Figure 12 - Scene graph example **58**

Figure 13 - 2D co-ordinate system (AR = Aspect Ratio) **59**

Figure 14 - BIFS-Command Types **66**

Figure 15 - A CompositeTexture2D **example. The 2D scene is projcted onto the 3D cube.** **134**

Figure 16 - A CompositeTexture2D **example.** **134**

Figure 17 - CompositeTexture3D **example. The 3D view of the earth is projected onto the 3D cube** **135**

Figure 18 - Curve **node example** **140**

Figure 19 - An arbitrary motion trajectory is approximated as a piece-wise linear one. **144**

Figure 20 - A FIG example **151**

Figure 21 - Visual result of the Form node example **157**

Figure 22 - IndexedFaceSet2D **default texture mapping coordinates for a simple shape** **160**

Figure 23 - Three Layer2D **and** Layer3D **examples composed in a 2D space.** **164**

Figure 24 - Cap and join style for LineProperties **167**

Figure 25 - Valuator functionaliy **189**

Figure 26 - The sync layer **192**

Figure 27 - Structure of FlexMux packet in simple mode **204**

Figure 28 - Structure of FlexMux packet in MuxCode mode **204**

Figure 29 - Example for a FlexMux packet in MuxCode mode **206**

iTeh STANDARD PREVIEW
(standards.iteh.ai)
ISO/IEC 14496-1:1999
https://standards.iteh.ai/catalog/standards/sist/0daedda7-8316-467d-9a1c-d17770f77200/iso-iec-14496-1-1999

Tables

Table 1 - List of Class Tags for Descriptors **15**

Table 2 - List of Class Tags for Commands **16**

Table 3 - ODProfileLevelIndication Values **24**

Table 4 - sceneProfileLevelIndication Values **24**

Table 5 - audioProfileLevelIndication Values **25**

Table 6 - visualProfileLevelIndication Values **25**

© ISO/IEC 1999 – All rights reserved