
**Information technology — Generic digital
audio-visual systems —**

**Part 3:
Contours: Technology domain**

*Technologies de l'information — Systèmes audiovisuels numériques
génériques —*

Partie 3: Contours: Domaine des technologies

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.

© 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

Contents	Page
Foreword	iv
Introduction	v
1. Scope.....	1
2. Normative references.....	1
3. Definitions.....	5
4. Acronyms and abbreviations	5
5. Conventions	8
6. Concepts — Contours, Systems and Interoperability	8
Annex A (normative) Enhanced Digital Broadcast (EDB) Technology Domain	11
A.1 Scope	11
A.2 Overview of system functions	11
A.3 Cross Reference between System Requirements and System Functions	17
A.4 List of tools required to implement the system functions.....	28
Annex B (normative) Interactive Digital Broadcast (IDB) Technology Domain.....	51
B.1 Scope	51
B.2 Overview of system functions	51
B.3 Cross Reference between System Requirements and System Functions	57
B.4 List of tools required to implement the system functions.....	68
Bibliography.....	94

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 16500 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 16500-3 was prepared by DAVIC (Digital Audio-Visual Council) and was adopted, under the PAS procedure, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

ISO/IEC 16500 consists of the following parts, under the general title *Information technology — Generic digital audio-visual systems*:

- *Part 1: System reference models and scenarios*
- *Part 2: System dynamics, scenarios and protocol requirements*
- *Part 3: Contours: Technology domain*
- *Part 4: Lower-layer protocols and physical interfaces*
- *Part 5: High and mid-layer protocols*
- *Part 6: Information representation*
- *Part 7: Basic security tools*
- *Part 8: Management architecture and protocols*
- *Part 9: Usage information protocols*

Annexes A and B form a normative part of this part of ISO/IEC 16500.

Introduction

ISO/IEC 16500 defines the minimum tools and dynamic behavior required by digital audio-visual systems for end-to-end interoperability across countries, applications and services. To achieve this interoperability, it defines the technologies and information flows to be used within and between the major components of generic digital audio-visual systems. Interoperability between these components and between individual sub-systems is assured through specification of tools and specification of dynamic systems behavior at defined reference points. A reference point can comprise one or more logical (non-physical) information-transfer interfaces, and one or more physical signal-transfer interfaces. A logical interface is defined by a set of information flows and associated protocol stacks. A physical interface is an external interface and is fully defined by its physical and electrical characteristics. Accessible reference points are used to determine and demonstrate compliance of a digital audio-visual subsystem with this international standard.

A summary of each part follows.

ISO/IEC 16500-1 (DAVIC 1.3.1a Part 2) defines the normative digital audio-visual systems technical framework. It provides a vocabulary and a Systems Reference Model, which identifies specific functional blocks and information flows, interfaces and reference points.

ISO/IEC 16500-2 (DAVIC 1.3.1a Part 12) defines system dynamic behavior and physical scenarios. It details the locations of the control functional entities along with the normative protocols needed to support the systems behavior. It is structured as a set of protocol walk-throughs, or "*Application Notes*", that rehearse both the steady state and dynamic operation of the system at relevant reference points using specified protocols. Detailed dynamics are given for the following scenarios: video on demand, switched video broadcast, interactive broadcast, and internet access.

ISO/IEC 16500-3 (DAVIC 1.3.1a Part 14) provides the normative definition of DAVIC Technology Contours. These are strict sets of Applications, Functionalities and Technologies which allow compliance and conformance criteria to be easily specified and assessed. This part of ISO/IEC 16500 contains the full details of two contours. These are the Enhanced Digital Broadcast (EDB) and Interactive Digital Broadcast (IDB). ISO/IEC 16500-3 specifies required technologies and is a mandatory compliance document for contour implementations.

ISO/IEC 16500-4 (DAVIC 1.3.1a Part 8) defines the toolbox of technologies used for lower layer protocols and physical interfaces. The tools specified are those required to digitize signals and information in the Core Network and in the Access Network. Each tool is applicable at one or more of the reference points specified within the Delivery System. In addition a detailed specification is provided of the physical interfaces between the Network Interface Unit and the Set Top Unit and of the physical interfaces used to connect Set Top Boxes to various peripheral devices (digital video recorder, PC, printer). The physical Delivery System mechanisms included are copper pairs, coaxial cable, fiber, HFC, MMDS, LMDS, satellite and terrestrial broadcasting.

ISO/IEC 16500-5 (DAVIC 1.3.1a Part 7) defines the technologies used for high and mid-layer protocols for ISO/IEC 16500 digital audio-visual systems. In particular, this part defines the specific protocol stacks and requirements on protocols at specific interfaces for the content, control and management information flows.

ISO/IEC 16500-6 (DAVIC 1.3.1a Part 9) defines what the user will eventually see and hear and with what quality. It specifies the way in which monomedia and multimedia information types are coded and exchanged. This includes the definition of a virtual machine and a set of APIs to support interoperable exchange of program code. Interoperability of applications is achieved, without specifying the internal design of a set top unit, by a normative Reference Decoder Model which defines specific memory and behavior constraints for content decoding. Separate profiles are defined for different sets of multimedia components.

ISO/IEC 16500-7 (DAVIC 1.3.1a Part 10) defines the interfaces and the security tools required for an ISO/IEC 16500 system implementing security profiles. These tools include security protocols which operate across one or both of the defined conditional access interfaces CA0 and CA1. The interface CA0 is to all security and conditional access functions, including the high speed descrambling functions. The interface CA1 is to a tamper resistant device used for low speed cryptographic processing. This cryptographic processing function is implemented in a smart card.

ISO/IEC 16500-8 (DAVIC 1.3.1a Part 6) specifies the information model used for managing ISO/IEC 16500 systems. In particular, this part defines the managed object classes and their associated characteristics for managing the access network and service-related data in the Delivery System. Where these definitions are taken from existing standards, full reference to the required standards is provided. Otherwise a full description is integrated in the text of this part. Usage-related information model is defined in ISO/IEC 16500-9.

ISO/IEC 16500-9 (DAVIC 1.3.1a Part 11) specifies the interface requirements and defines the formats for the collection of usage data used for billing, and other business-related operations such as customer profile maintenance. It also specifies the protocols for the transfer of Usage Information into and out of the ISO/IEC 16500 digital audio-visual system. In summary, flows of audio, video and audio-visual works are monitored at defined usage data collection elements (e.g., servers, elements of the Delivery System, set-top boxes). Information concerning these flows is then collected, processed and passed to external systems such as billing or a rights administration society via a standardised usage data transfer interface.

Additional Information

ISO/IEC TR 16501 is an accompanying Technical Report. Further architectural and conformance information is provided in other non-normative parts of DAVIC 1.3.1a (1999). A summary of these documents is included here for information.

ISO/IEC TR 16501 (DAVIC 1.3.1a Part 1) provides a detailed listing of the functionalities required by users and providers of digital audio-visual applications and systems. It introduces the concept of a contour and defines the IDB (Interactive Digital Broadcast) and EDB (Enhanced Digital Broadcast) functionality requirements which are used to define the normative contour technology toolsets provided in ISO/IEC 16500-3.

DAVIC 1.3.1a Parts 3, 4 and 5 are DAVIC technical reports. They provide additional architectural and other information for the server, the delivery-system, and the Service Consumer systems respectively. Part 3 defines how to load an application, once created, onto a server and gives information and guidance on the protocols transmitted from the set-top user to the server, and those used to control the set-up and execution of a selected application. Part 4 provides an overview of Delivery Systems and describes instances of specific DAVIC networked service architectures. These include physical and wireless networks. Non-networked delivery (e.g., local storage physical media like discs, tapes and CD-ROMs) are not specified. Part 5 provides a Service Consumer systems architecture and a description of the DAVIC Set Top reference points defined elsewhere in the normative parts of the specification.

DAVIC 1.3.1a Part 13 is a DAVIC technical report, which provides guidelines on how to validate the systems, technology tools and protocols through conformance and / or interoperability testing.

Information technology — Generic digital audio-visual systems — Part 3: Contours: Technology domain

1. Scope

This part of ISO/IEC 16500 on “Contours: Technology Domain” describes the system functions and DAVIC tools relevant to the Contours defined in ISO/IEC TR 165001. A goal of this part of ISO/IEC 16500 is to guide implementers to those parts of ISO/IEC 16500 which are relevant for the implementation of the systems in each Contour and to show the relation between the various tools. Another goal of this specification is to state which specific DAVIC tools have to be implemented to realize interoperable system components.

As the underlying trade-off between system component cost and service revenue may vary considerably, e.g., by geographical location and time, this trade-off is deemed to be outside of the scope of DAVIC and hence a more detailed “micro profiling” of the tool set needs to be agreed upon between the various parties involved with the realization of a system. An STB that is fully interoperable with, for example, Enhanced Broadcast Services within a certain geographical area, can be designed by implementing all defined DAVIC tools used by the Enhanced Broadcast Services in that area.

In order to assist the above mentioned micro-profiling activity the DAVIC tools relevant to a specific Contour have been structured in the following way. A collection of DAVIC tools (sub/clauses of ISO/IEC 16500) which together realize a complete system function (e.g., the reliable transmission of synchronized multimedia information) are grouped together. The group is identified as “system function”. For each of these groups an overall informative description is given and a table listing in detail the included DAVIC tools. For the tools dependencies are indicated if applicable. The functional requirements derived from the User & Market Domain of a contour (see ISO/IEC TR 16501) are fully mapped to the above list of system functions.

2. Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 16500. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 16500 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau (TSB) maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

1. ITU-T Recommendation H.222.0 (1995) | ISO/IEC 13818-1: 1996, *Information technology—Generic coding of moving pictures and associated audio information: Systems* (Note: known as MPEG-2).
 - ISO/IEC 13818-1/Amendment 1: 1997, *Registration procedure for “copyright identifier”*.
 - ISO/IEC 13818-1/Amendment 2: 1997, *Registration procedure for “format identifier”*.
 - ISO/IEC 13818-1/Amendment 3: 1998, *Private data identifier*.
2. ITU-T Recommendation H.262 | ISO/IEC 13818-2:1996, *Information technology—Generic coding of moving pictures and associated audio information: Video* (Note: known as MPEG-2).
 - ISO/IEC 13818-2 /Amendment 1: *Registration procedure for “copyright identifier”*.

2.2 Similar Recommendations | International Standards

The following Recommendations or International standards have equivalent technical content:

1. ITU-T (CCITT) Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1)* | ISO/IEC 8824: 1990, *Information technology — Open Systems Interconnection — Specification of Abstract Syntax Notation One (ASN.1)*.
2. ITU-T (CCITT) Recommendation X.209 (1988) *Specification of Basic Encoding rules for abstract syntax notation one (ASN.1)* | ISO/IEC 8825: 1990, *Information technology — Open Systems Interconnection — Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1)*.
3. ITU-T Recommendation X.218 (1995), *Reliable transfer: model and service definition* | ISO/IEC 9066-1: 1989, *Information Processing Systems — Text Communication — Reliable Transfer — Model and service definition for the Association Control Service Element*.
4. ITU-T (CCITT) Recommendation X.219 (1988) *Remote operations: Model, notation and service definition* | ISO/IEC 9072-1: 1989, *Information processing systems—Text communication—Remote Operations: Model, notation and service definition*.

2.3 Additional References

1394 Trade Association

1. *AV/DICS Specification for AV/C Digital Interface Command Set, September 13, 1996.*
available at http://firewire.org/abouttech/specifications/1394_AVC.pdf

Apple Computer Inc.

1. *AIFF-C Audio Interchange File Format, version C, A revision allowing for Compression.*
(Note: Required specification is provided in ISO/IEC 16500-6 Annex B. AIFF is also available at <http://www.apple.com/quicktime/developers/ffda.html>.)

ATM (Asynchronous Transfer Mode) Forum

1. af-phy-0017.000 - *UTOPIA: an ATM-PHY Interface Specification, Level 1, Version 2.01, March 21, 1994.* available at <ftp://ftp.atmforum.com/pub/approved-specs/af-phy-0017.000.pdf>

ATSC (Advanced Television Systems Committee)

1. ATSC A/52: *Digital Audio Compression Standard (AC-3).*
available at <ftp://ftp.atsc.org/pub/Standards/A52>

CENELEC (Comité Européen de Normalisation Electrotechnique)

1. CENELEC EN 50221, *Common Interface for Conditional Access and other Digital Video Decoder Applications.*

DVB (Digital Video Broadcasting)

1. DVB A007 *see* ETSI ETR 289
2. DVB Document A010 *see* CENELEC EN 50083-9
3. DVB Blue Book A017 *see* CENELEC EN 50221

ETSI (European Telecommunications Standards Institute)

1. ETR 162 (October 1995): *Digital broadcasting systems for television, sound and data services: Allocation of Service Information (SI) codes for Digital Broadcasting (DVB) systems.*
2. ETR 211: *Digital broadcasting systems for television, sound, and data services; Guidelines for the usage of Service Information (SI) in Digital Video Broadcasting (DVB) systems.*
3. ETR 289 (October 1996): *Support for use of Scrambling and Conditional Access (CA) within Digital Broadcasting Systems.*

4. ETS 300 421 (December 1994): *Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for 11/12 GHz satellite services.*
5. ETS 300 468 (January 1997): *Specification for Service Information (SI) in DVB Systems.*
 - Informative Annex C: *Conversion Between Time and Date Conventions*
6. ETS 300 472 (October 1996), *Digital broadcasting systems for television, sound, and data services; Specification for conveying ITU-R System B Teletext in Digital Video Broadcasting (DVB) bitstreams.*
7. ETS 300 743, *Digital Video Broadcasting (DVB), DVB subtitling.*
8. ETS 300 777-2, *Use of Digital Storage Media Command and Control (DSM-CC) for basic multimedia applications.*

IEC (International Electrotechnical Commission)

1. IEC 61883-1:1997, *Digital Interface for Consumer Electronics Audio/Video Equipment – General.*
2. IEC 61883-4:1997, *Digital Interface for Consumer Electronics Audio/Video Equipment – MPEG-2 TS Data Transmission.*

IEEE (Institute of Electrical and Electronics Engineers)

1. IEEE 1394-1995 *Standard for a High Performance Serial Bus, August 1996.*

Internet Society

1. RFC 768, J. Postel, *User Datagram Protocol (UDP)*, 08/28/1980 (STD-6).
2. RFC 791, J. Postel, *Internet Protocol (IP Addressing)*, 09/01/1981 (STD-5).
3. RFC 793, J. Postel, *Transmission Control Protocol (TCP)*, 09/01/1981 (STD-7).
4. RFC 1662, W. Simpson, *PPP in HDLC-like Framing*, 07/21/1994 (STD-51).
5. RFC 1700, J. Reynolds, J. Postel, *Assigned Numbers*, 10/20/1994 (STD-2).

ISO (International Organization for Standardization)

1. ISO 639, *Codes for the representation of names of languages.*
2. ISO 3166, *Codes for the representation of names of countries.*
3. ISO 8859-1:1987, *Information technology - 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No. 1.*

ISO/IEC

1. ISO/IEC 7816-1:1987, *Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics.*
2. ISO/IEC 7816-2:1988, *Identification cards - Integrated circuit(s) cards with contacts - Part 2: Dimensions and location of the contacts.*
3. ISO/IEC 7816-3:1989, *Identification cards - Integrated circuit(s) cards with contacts - Part 3: Electronic signals and transmission protocols.*
4. ISO/IEC 7816-4:1995, *Identification cards - Integrated circuit(s) cards with contacts - Part 4: Interindustry commands for interchange.*
5. ISO/IEC 7816-5:1994, *Identification cards - Integrated circuit(s) cards with contacts - Part 5: Numbering system and registration procedure for application identifiers.*
6. ISO/IEC 7816-6:1996, *Identification cards - Integrated circuit(s) cards with contacts - Part 6: Interindustry data elements.*
7. ISO/IEC 10646-1, *Information technology - Universal Multiple-Octet Coded Character Set (UCS), Part 1: Architecture and Basic Multilingual Plane”* (also known as Unicode).
8. ISO/IEC 11172-2:1993, *Information technology—Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s—Part 2: Video* (Note: known as MPEG-1).
9. ISO/IEC 11172-3:1993, *Information technology—Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s—Part 3: Audio* (Note: known as MPEG-1).

10. ISO/IEC 13522-5:1997, *Information technology—Coding of Multimedia and Hypermedia Information—Part 5: Support for Base-Level Interactive Applications* (Note: known as MHEG-5).
11. ISO/IEC 13522-6, *Information technology - Coding of multimedia and hypermedia information (MHEG) - Part 6: Support for Enhanced Interactive Applications*.
12. ISO/IEC 13818-6, *Information technology—Generic coding of moving pictures and associated audio information—Part 6: Extensions for DSM-CC*.
13. ISO/IEC 13818-9:1996, *Information technology—Generic coding of moving pictures and associated audio information—Part 9: Extension for real-time interface for systems decoders*.
14. ISO/IEC 14750, *Information technology -- Open Distributed Processing - Interface Definition Language*.

ITU-R (International Telecommunications Union - Radiocommunication Sector)

1. ITU-R BT.601-4, *Encoding parameters of digital television for studios*.
2. ITU-R BT.709-1, *Basic parameter values for the HDTV standard for the studio and for international program exchange*.
3. ITU-R BT.1208, *Video coding for digital terrestrial television broadcasting*.

ITU-T (International Telecommunication Union - Telecommunication Standardization Sector)

1. ITU-T Recommendation E.164 / I.331 (1991) *Numbering plan for the ISDN era*.
2. ITU-T Recommendation I.361 (1995) *B-ISDN ATM layer specification*.
3. ITU-T recommendation V.22 (1988), *1200 bits per second duplex modem standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits*.
4. ITU-T Recommendation V.22 bis (1988), *2400 bits per second duplex modem using the frequency division technique standardized for use on the general switched telephone network and on point-to-point 2-wire leased telephone-type circuits*.
5. ITU-T Recommendation V.32 (1993), *A family of 2-wire, duplex modems operating at data signaling rates of up to 9600 bit/s for use on the general switched telephone network and on leased telephone-type circuits*.
6. ITU-T Recommendation V.32 bis (1991), *A duplex modem operating at data signaling rates of up to 14400 bit/s for use on a general switched telephone network and on leased point-to-point 2-wire telephone-type circuits*.
7. ITU-T Recommendation V.34 (1994), *A modem operating at data signaling rates of up to 28800 bit/s for use on the general switched telephone network and on leased point-to-point 2-wire telephone-type circuits, version September 1994, published December 1994*.

OMG (Object Management Group)

1. *Common Object Request Broker: Architecture and Specification, version 2.1 August 1997*. (Note: known as OMG CORBA 2.1).

PCMCIA (Personal Computer Memory Card International Association)

1. Personal Computer Memory Card International Association, *PC Card Standard, Volume 2 - Electrical Specification*, February 1995.
2. Personal Computer Memory Card International Association, *PC Card Standard, Volume 3 - Physical Specification*, February 1995.
3. Personal Computer Memory Card International Association, *PC Card Standard, Volume 4 - Metaformat Specification*, February 1995.

Philips Semiconductor B.V.

1. Philips Semiconductor Specification, *The I²C-bus and How to Use It (Including Specifications)*, 1995. Update, released April 1995, by Philips Semiconductor, Document number 9398-393-40011

SMPTE (Society of Motion Picture & Television Engineers)

1. SMPTE 274M *see* ANSI SMPTE 274M-1995
2. SMPTE S17.392 *see* ANSI SMPTE 296M-1997

W3C (WorldWide Web Consortium)

1. HTML 3.2, *HyperText Mark-up Language reference specification, 14-Jan-1997*