INTERNATIONAL STANDARD

ISO/IEC 16500-5

First edition
1999-12-15

Information technology — Generic digital audio-visual systems —

Part 5: High and mid-layer protocols

Technologies de l'information — Systèmes audiovisuels numériques génériques —

Partie 5: Protocoles de la couche haute et moyenne

Reference number
ISO/IEC 16500-5:1999(E)

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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

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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 16500-5 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 ISO/IEC 16500. Annex C is for information only.

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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.

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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.

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Information technology — Generic digital audio-visual systems — Part 5: High and mid-layer protocols

1. Scope

This part of ISO/IEC 16500 covers the high and mid layer protocols for DAVIC systems. It defines a set of protocol components ("tools") which are referenced by ISO/IEC 16500-2 ("System Dynamics, Scenarios, and Protocol Requirements").

In particular this part of ISO/IEC 16500 describes the protocol stacks required for the support of the DAVIC flows, i.e., S1 through S5. The specific DAVIC options for each of the protocols are specified as well as the different optional protocols stacks applicable. Requirements on protocols at specific interfaces are also considered and included in the specification.

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

- ITU-T Recommendation H.220.0 (1996) | ISO/IEC 13818-1:1996, *Information technology – Generic coding of moving pictures and associated audio information – Part 1: 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.*
- ITU-T Recommendation H.262 (1996) | ISO/IEC 13818-2:1996, *Information technology – Generic coding of moving pictures and associated audio information: Video* (Note: known as MPEG-2).
- ITU-T Recommendation X.215 (1995) | ISO/IEC 8326:1996, *Information technology — Open Systems Interconnection — Session service definition.*
- ITU-T Recommendation X.216 (1994) | ISO/IEC 8822:1994, *Information technology – Open Systems Interconnection – Presentation service definition.*
- ITU-T Recommendation X.217 (1995) | ISO/IEC 8649:1996, *Information technology – Open Systems Interconnection – Service definition for the Association Control Service Element.*
- ITU-T Recommendation X.225 (1995) | ISO/IEC 8327-1:1996, *Information Technology – Open Systems Interconnection – Connection-oriented session protocol: Protocol specification.*
- ITU-T Recommendation X.226 (1994) | ISO/IEC 8823-1:1994, *Information Technology – Open Systems Interconnection – Connection-oriented protocol: Protocol specification.*
- ITU-T Recommendation X.233 (1993) | ISO/IEC 8473-1:1994, *Information technology – Protocol for providing the connectionless-mode network service: Protocol specification.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- 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).*

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- 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 – ASN.1 encoding rules - Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER) for Abstract Syntax Notation One (ASN.1).*
- 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.*
- 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.*
- ITU-T Recommendation X.224 (1993), *Protocol for providing the OSI connection-mode transport service*.

  ISO/IEC 8073:1992, *Information technology – Telecommunications and information exchange between systems – Open Systems Interconnection – Protocol for providing the connection-mode transport service.*
- ITU-T (CCITT) Recommendation X.229 (1988), *Remote operations: Protocol specification.*

  ISO/IEC 9072-2:1989, *Information processing systems – Text communication – Remote Operations: Protocol specification.*

2.3 IEC, ISO, and ISO/IEC Standards

- IEC 61883-1:1997, *Consumer audio/video equipment – Digital Interface. – Part 1: General.*
- IEC 61883-4:1997, *Consumer audio/video equipment – Digital Interface – Part 4: MPEG-2 TS data transmission.*
- ISO/IEC 11172-2:1993, *Information technology – Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbits/s – Part 2: Video.* (Note: also known as MPEG-1).
- ISO/IEC 11172-3:1993, *Information technology Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbits/s – Part 3: Audio.* (Note: also known as MPEG-1).
- ISO/IEC 13818-3:1998, *Information technology – Generic coding of moving pictures and associated audio information – Part 3: Audio*. (MPEG-2).
- ISO/IEC 13818-6:1998, *Information technology – Generic coding of moving pictures and associated audio information – Part 6: Extensions for DSM-CC.*
- ISO/IEC 14750, Information technology – Open distributed processing - *Interface Definition Language.*
- ISO/IEC 7776:1995, *Information technology – Telecommunications and information exchange between systems – High-level data link control procedures – Description of the X.25 LAPB-compatible DTE data link procedures.*
- ISO/IEC 8802-2:1994, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical link control.*
- ISO/IEC 8802-3:1993, *Information technology – Local and metropolitan area networks – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.*

2.4 ITU-T Recommendations

- ITU-T Recommendation E.164 (R/1996) *Numbering plan for the ISDN era*
- ITU-T Recommendation G.774 (1992), *Synchronous digital hierarchy management information model*
- ITU-T I.150 (R/1995), *B-ISDN asynchronous transfer mode functional characteristics*
- ITU-T Recommendation I.361 (R/1996), *B-ISDN ATM layer specification*
- ITU-T Recommendation I.363 (R/1994), *B-ISDN ATM adaptation layer (AAL) specification*

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- ITU-T Recommendation I.363.5 (1996), *B-ISDN ATM Adaptation Layer Type 5 (AAL5) specification*
- ITU-T Recommendation I.610 (R/1995), *B-ISDN operation and maintenance principles and functions*
- ITU-T Recommendation M.3100 (1995), *Generic network information model*
- ITU-T Recommendation Q.822 (1994), *Stage 1, Stage 2, Stage 3 description for the Q3 interface - Performance management*
- ITU-T Recommendation Q.2110 (1994), *B-ISDN ATM Adaptation Layer – Service Specific Connection Oriented Protocol (SSCOP)*
- ITU-T Recommendation Q.2120 (1995), *B-ISDN meta-signaling protocol (SAAL)*
- ITU-T Recommendation Q.2130 (1994), *B-ISDN ATM Adaptation Layer- Service Specific Coordination Function for Support of Signaling at the User Network Interface (SSCF at UNI)*
- ITU-T Recommendation Q.2931 (1995), *Broadband integrated services digital network (B-ISDN). Digital Subscriber Signaling System No.2 (DSS 2): User-network interface (UNI) layer 3 specification for basic call/connection control*
- CCITT Recommendation V.35, *Data transmission at 48 Kilobits per second using 60-108 kHz Group Band Circuits*
- ITU-T Recommendation X.25 (1993), *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit*
- ITU-T Recommendation X.710 (1991), *Common management information service definition for CCITT applications*
- ITU-T Recommendation X.711 (1991), *Common Management Information Protocol, Specification for CCITT applications*
- ITU-T Recommendation X.721 (R/1994), *Information Technology – Open Systems Interconnection – Structure of Management Information: Definition of Management Information*

2.5 Other normative references

2.5.1 ANSI

- ANSI EIA/TIA-232-E-91, *Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*, July 1991

2.5.2 The ATM Forum

- AF-SAA-0049.001, The ATM Forum, *Audiovisual Multimedia Services: Video on Demand Specification 1.1*, 1997

2.5.3 Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA)

- RS-232-C, *see* ANSI/EIA/TIA-232-E-91

2.5.4 European Telecommunications Standards Institute (ETSI)

- ETSI 300 468, *Digital Video Broadcasting, Specification for Service Information in DVB Systems*, January 1997
  (Note: includes normative reference to the *Informative Annex C: Conversion Between Time and Date Conventions.*)

2.5.5 Institute for Electrical and Electronic Engineers (IEEE)

- IEEE 802.2, *see* ISO/IEC 8802-2
- IEEE 802.3, *see* ISO/IEC 8802-3

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

2.5.6 Internet Society

- RFC 768, J. Postel, *User Datagram Protocol (UDP)*, 08/28/1980
- RFC 791, J. Postel, *Internet Protocol (IP Addressing)*, 09/01/1981
- RFC 793, J. Postel, *Transmission Control Protocol (TCP)*, 09/01/1981
- RFC 826, D. Plummer, *Ethernet Address Resolution Protocol: Or converting network protocol addresses to 48.bit Ethernet address for transmission on Ethernet hardware*, 11/01/1982
- RFC 1006, D. Cass, M. Rose, *ISO transport services on top of the TCP: Version 3*, 05/01/1987
- RFC 1155, K. McCloghrie, M. Rose, *Structure and Identification of Management Information for TCP/IP-based Internets*, 05/10/1990
- RFC 1157, M. Schoffstall, M. Fedor, J. Davin, J. Case, *A Simple Network Management Protocol (SNMP)*, 05/10/1990
- RFC 1212, K. McCloghrie, M. Rose, *Concise MIB Definitions*, 03/26/1991
- RFC 1213, K. McCloghrie, M. Rose, *Management Information Base for Network Management of TCP/IP-based internets: MIB-II*, 03/26/1991
- RFC 1662, W. Simpson, *PPP in HDLC-like Framing*, 07/21/1994
- RFC 1700, J. Reynolds, J. Postel, *Assigned Numbers*, 10/20/1994
  (Note: this supercedes RFC 1060 and 1340. The IETF regularly updates “Assigned Numbers” so this reference may be obsolete in the future)

2.5.7 Object Management Group (OMG)

- *Common Object Request Broker: Architecture and Specification*, Version 2.1, August 1997
  (Note: known as OMG CORBA 2.1. Includes definition of the Common Data Representation and the Remote Procedure Call mechanism and encoding rules for General Inter-ORB Protocol, and Internet Inter-ORB Protocol).

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