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Part 4: Lower-layer protocols and physical interfaces

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Partie 4: Protocoles et interfaces physiques de la couche inférieure

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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 16500-4 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*

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 4: Lower layer protocols and physical interfaces

1. Scope

This part of ISO/IEC 16500 provides a toolbox consisting of lower layer protocols and physical interfaces. Each tool is applicable at one or more of the reference points within the delivery system. The physical delivery media that have been identified for this version of ISO/IEC 16500-4 are copper pairs, coaxial cable, microwave, fiber and satellite. Removable information carrying physical media (e.g. optical discs and tapes) are not covered. The tools listed address the three parts of the delivery system, namely, the core network, the access network and the access-network-independent interface to the Set Top Unit (STU). Tools are also identified for the STU dataport interface and for a service provider system (SPS) internal network and an SPS/SPS core network.

Clause 6 specifies in detail the tools provided to digitize the physical media in the core network. In the case of a broadband core network, all these tools support high speed ATM transport. Clause 7 specifies in detail the tools provided to digitize the physical media in the access network (copper pairs, coax, satellite, microwave, fiber). All these tools support high speed MPEG-2-TS transport and/or high speed ATM transport. Clause 8 concerns the access-network-independent interface to the STU and provides a detailed specification of the physical interfaces between the network interface unit (NIU) and the STU. This physical interface can be internal or external to the Set Top Box (STB) and is independent from the physical interface used in the access network. It supports the transport of MPEG-2-TS and ATM between NIU and STU. Clause 9 concerns the STU dataport interface and specifies the physical interfaces used to connect an STB to various peripheral devices. It defines normative STU multimedia dataport tools and interfaces and also includes informative specifications for both PC and parallel dataports. These interfaces support the transport of MPEG-2-TS or IP. Clause 10 defines the physical interfaces for interconnections between cascaded SPS entities with or without an intervening core network and the physical interfaces for networks used to connect various hosts within an SPS.

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 IEC, ISO, ISO/IEC and ITU-T normative references

IEC 60801–4:1988 *Electromagnetic compatibility for industrial process measurement and control equipment. Part 4: Electrical fast transient/burst requirements*

IEC 61883-1:1998, *Consumer audio/video equipment – Digital interface – Part 1: General.*

IEC 61883-4:1998, *Consumer audio/video equipment – Digital interface – Part 4: MPEG-2 TS data transmission.*

ISO/IEC 7816-3:1989, *Identification cards – Integrated circuit(s) cards with contacts – Part 3: Electronic signals and transmission protocols.*

ISO/IEC 8802-3:1996, *Information technology - Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.*

ISO/IEC 8877: 1987, *Information technology – Telecommunications and information exchange between systems – Interface connector and contact assignments for ISDN Basic Access Interface located at reference points S and T.*

ISO/IEC 11801:1995, *Generic cabling for customer premises, standards for generic cabling for information technology.*

ISO/IEC 13818-1:1996, *Information technology – Generic coding of moving pictures and associated audio information: Systems*

ISO/IEC 13818-9:1996, *Extension for real-time interface for systems decoders*.
ITU General Secretariat, Radio Regulations (1990), Volume 1, Article 8, Frequency Allocations Chapter RR8.
ITU-R Recommendation 656. *Recommendations of the ITU-R (formerly CCIR), 1990 -- CCIR 656*, Part I.
ITU-T Recommendation G.117 [Blue Book], *Transmission aspects of unbalance about earth (definitions and methods)*, version CCITT PA 1988, published March 1990.
ITU-T Recommendation G.652 [Rev. 1], *Characteristics of a single-mode optical fiber cable*, version WTSC 1993, published February 1994.
ITU-T Recommendation G.704 [Rev. 2], *Synchronous frame structures used at levels of 1544, 6312, 2048, 8448 and 44736 kbit/s*, July 95.
ITU-T Recommendation G.707 [Rev. 2], *Synchronous digital hierarchy bit rates*, version WTSC 1993, published August 1993.
ITU-T Recommendation G.708, [Rev. 2*], Network node interface for synchronous digital hierarchy*, version WTSC 1993, published November 1993.
ITU-T Recommendation G.709 [Rev. 2*], Digital transmission systems - Terminal Equipment - General*, version WTSC 1993, published December 1993.
ITU-T Recommendation G.804 [New*], ATM cell mapping into plesiochronous digital hierarchy (PDH)*, version November 1993, published October 1994.
ITU-T Recommendation G.832 (11/1995), *Transport of SDH elements on PDH networks: Frame and multiplexing structures.*
ITU-T Recommendation G.957 (07/1995), *Optical interfaces for equipment and systems relating to the synchronous digital hierarchy*.
ITU-T Recommendation G.981 [New*], PDH optical line systems for the local network*, version January 1994, published November 1994.
ITU-T Recommendation I.361 (11/1995), *B-ISDN ATM layer specification*.
ITU-T Recommendation I.363.5 (08/1996), *B-ISDN ATM adaptation layer (AAL) specification: Type 5 AAL*.
ITU-T Recommendation I.413 [Rev. 1], *B-ISDN user-network interface*, version WTSC 1993, published December 1993.
ITU-T Recommendation I.430 [Rev. 1], *Basic user-network interface - Layer 1 specification*, version WTSC 1993, published March 1994.
ITU-T Recommendation I.432 [Rev. 1], *B-ISDN user-network interface - Physical layer specification*, version WTSC 1993, published January 1994.
ITU-T Recommendation O.9 [Blue Book], *Measuring arrangements to assess the degree of unbalance about earth*, version CCITT PA 1988, published July 1990.
ITU-T Recommendation V.22 [Blue Book], *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*, version CCITT PA 1988, published November 1989.
ITU-T Recommendation V.22 bis [Blue Book], *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*, version CCITT PA 1988, published November 1989.
ITU-T Recommendation V.32 [Rev.1], *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*, version WTSC 1993, published January 1994.
ITU-T Recommendation V.32 bis [New], *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*, version February 1991, published May 1991.
ITU-T Recommendation V.34 [New], *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.

2.2 Other normative references

1394 Trade Association, *Specification for AV/C Digital Interface Command Set*, September 13, 1996. Figure 5-1.
ADSL Forum TR-002, *ATM over ADSL Recommendations*, March 1997 http://www.adsl.com/adsl_atm.html.
Scope Note: Sections B.2, 3 (except only a single latency path shall be implemented, see 3.2), 4, 6.2, and 7.
ANSI Standard T1.105, *SONET Basic Description including Multiplex Structure, Rate and Formats.*
ANSI Standard T1.105.01, *SONET Automatic Protection Switching.*
ANSI Standard T1.105.02, *SONET Payload Mappings.*
ANSI Standard T1.105.03, *SONET Jitter and Network Interfaces*.
ANSI Standard T1.105.04, *SONET Data Communication Channel Protocols and Architectures.*
ANSI Standard T1.105.05, *SONET Tandem Connection Maintenance.*

ANSI Standard T1.105.06, *SONET Physical Layer Specification.*
ANSI Standard T1.105.07, *SONET Sub STS-1 Interface Rates and Formats Specifications.*
ANSI Standard T1.105.08, *SONET Directory Service for TMN and SONET.*
ANSI Standard T1.105.09, *SONET Timing and Synchronization.*
ANSI Standard T1.413, *Network and customer installation interfaces - Asymmetrical Digital Subscriber Line (ADSL) Metallic Interface*, version March 95.
ATM Forum, *Physical Interface Specification for 25.6 Mbit/s over Twisted Pair Cable*, November 1995.
ATM Forum, *UTOPIA: an ATM-PHY Interface Specification*, Level 1, Version 2.01 March 21,1994.
Bellcore document GR-253 [Issue 02], *Set: Synchronous Optical Network (SONET) Transport; Systems: Common Generic Criteria.* December 1995.
CENELEC EN 50083-9, *Cabled distribution systems for television, sound and interactive multimedia signals. Part 9: Interfaces for CATV/SMATV headends and similar professional equipment for DVB/MPEG-2 transport streams.* March 1997.
DIN Specification 41612-5, *Test Specification*, October 1987.
ETSI specification ETS 300 421, *Digital broadcasting systems for television, sound and data services; Framing structure, channel coding and modulation for 11/12 GHz satellite services*, version December 1994.
ETSI *Technical Report 328 on ADSL*, edition 1, December 1996.
IEEE Standard 1284-1994, *Signaling Method for a Bidirectional Parallel Peripheral Interface for Personal Computers* (ISBN 1-55937-427-6) [SH17335-NXG] (Note: optional in ISO/IEC 16500- see Subclause 9.4 below)
IEEE Standard 1394-1995, *IEEE Standard for a High Performance Serial Bus.*
Philips Semiconductor Specification, *The I^2C-bus and how to use it (including specifications)*, 1995 Update, released April 1995, by Philips Semiconductor. Document number 9398-393-40011.

