



**DAVIC†1.2 Specification Part†5**  
**Service Consumer System Architecture**  
**(Technical Specification )**

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This revision of the **DAVIC†1.2** Specification **Part†5** document supersedes all previous versions.

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## FOREWORD

### **DAVIC**

The Digital Audio-Visual Council (DAVIC) is a non-profit Association registered in Geneva. Its purpose is to advance the success of emerging digital audio-visual applications and services, initially of the broadcast and interactive type, by the timely availability of internationally-agreed specifications of open interfaces and protocols that maximise interoperability across countries and applications or services. The DAVIC concept of *Digital Audio-Visual Applications and Services* includes all applications and services in which there is a significant digital audio video component.

The goals of DAVIC are to identify, select, augment, develop and obtain the endorsement by formal standards bodies of specifications of interfaces, protocols and architectures of digital audio-visual applications and services. These are realised through the open international collaboration of all players in the field. DAVIC intends to make the results of such activities available to all interested parties on reasonable terms applied uniformly and openly and to contribute the results of its activities to appropriate formal standards bodies.

### **DAVIC Membership**

Membership of DAVIC is open to any corporation or individual firm, partnership, governmental body or international organisation. DAVIC does not restrict membership on the basis of race, colour, sex, religion or national origin. By joining DAVIC each member agrees—both individually and collectively—to adhere to open competition in the development of digital audio-visual products, technology or services. Associate Member status is usually chosen by those entities, mostly government organisations, who do want to be members of the Council without taking an active role in the precise technical content of specifications.

DAVIC Members are not restricted in any way from designing, developing, marketing or procuring digital audio-visual hardware, software, systems, technology or services. Members are not bound to implement or use specific digital audio-visual standards, recommendations or DAVIC specifications by virtue of their participation in DAVIC.

In September 1996, DAVIC had membership of 219 corporations representing more than 20 countries from all over the world and virtually all business communities with a stake in the emerging field of digital audio-visual applications and services.

### **The DAVIC 1.2 Specification**

This Specification has been developed by participating DAVIC members on the basis of DAVIC 1.0 and DAVIC 1.1 and submissions from both members and non-members in response to Calls For Proposals which were issued in October 1994, March 1995, September 1995, December 1995 and March 1996.

The DAVIC 1.2 Specification is a super-set of DAVIC 1.1 and was frozen in June 1996 in the sense that all multiple choices retained in preceding revisions were reduced to just one solution—either by consensus or, where necessary, by a process of voting within a full meeting of the relevant Technical Committee and subsequent formal approval by the DAVIC General Assembly. Choices were then allowed to be reconsidered before the meeting in December 1996 only where inadequacies or inconsistencies could be demonstrated with other parts of the Specification. The Specification has been openly available on the Internet since June 1996 for the purpose of soliciting comments from all interested parties - both members and non-members - on technical issues pertaining to this version. Comments were considered at the scheduled December 1996 meeting in Hong Kong.

This Specification is a public document. Electronic copies of the document can be obtained from the DAVIC Secretariat or from the DAVIC Website.

### **Intellectual Property Rights**

The DAVIC Technical Committees were instructed to provide, to the best of their knowledge, a complete list of all items of Intellectual Property that are needed for implementation of the DAVIC 1.2 Specification. As a result of this process it was recognised that the ability to exploit Intellectual Property Rights (IPR) will be needed to implement some of the technologies selected by DAVIC for this Specification. As a condition for retaining their technologies, owners of IPR items that are required for implementing a part of the DAVIC specification have been asked to produce a statement of their availability and to either give free use of the patented items, or license on fair and reasonable terms and on a non-discriminatory basis following the IEC/ISO/ITU policy on IPR matters.

Information on such IPR items appears in document DAVIC/280, copy of which can be obtained from the DAVIC Secretariat.

In including an external standard or specification, DAVIC assumes the IEC/ISO/ITU IPR policy has been followed by the entity that produced the standard/specification but DAVIC is not in a position to make any expressed or implied guarantee in this regard.

### ***Interoperability tests***

DAVIC has requested its Systems Integration and Interoperability Technical Committee to organise interoperability tests of various implementations of its Specification to confirm interworking of the proposed technologies and protocols. A first interoperability event was held in conjunction with the New York Meeting in June 1996. Other events were held in Tokyo in October 1996 and are planned for Europe in 1997. Some results from interoperability tests conducted during the period September 1995 to September 1996 have already been taken into account in the DAVIC 1.2 Specification.

### ***The DAVIC Website***

Much more information which is being continually updated, is available on the Internet at the DAVIC Website at URL <http://www.davic.org> . The DAVIC Homepage has a brief outline of *What is DAVIC?* and *Latest News*. There are also hotlinks :-

<a href="#"><b>Introduction to DAVIC</b></a>	<a href="#"><b>Membership Information</b></a>	<a href="#"><b>Organisation</b></a>
<a href="#"><b>Specifications</b></a>	<a href="#"><b>Bulletin Board</b></a>	<a href="#"><b>DAVIC's FAQ's</b></a>

*Membership Information* points to membership guidelines and how to join DAVIC, gives a copy of the Statutes and a current list of members.

*Bulletin Board* provides recent press releases, Calls for Proposals, the DAVIC Workplan and the meeting schedule.

*Organisation* describes the structure of DAVIC and the people who populate its committees.

*Specifications* describes the philosophy of DAVIC's work and offers a directory structure from which the Specifications and Calls for Proposals can be downloaded.

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# INTRODUCTION

## *The DAVIC approach to specifications*

The figure below is a very general representation of the type of system addressed by DAVIC specifications. It comprises five entities: the Content Provider System, the Service Provider System and the Service Consumer System; connected by two other entities: a CPS-SPS Delivery System connecting the Content Provider System to the Service Provider System, and a SPS-SCS Delivery System connecting the Service Provider System to the Service Consumer System. In principle, DAVIC specifications can address any subsystem in a similar context.

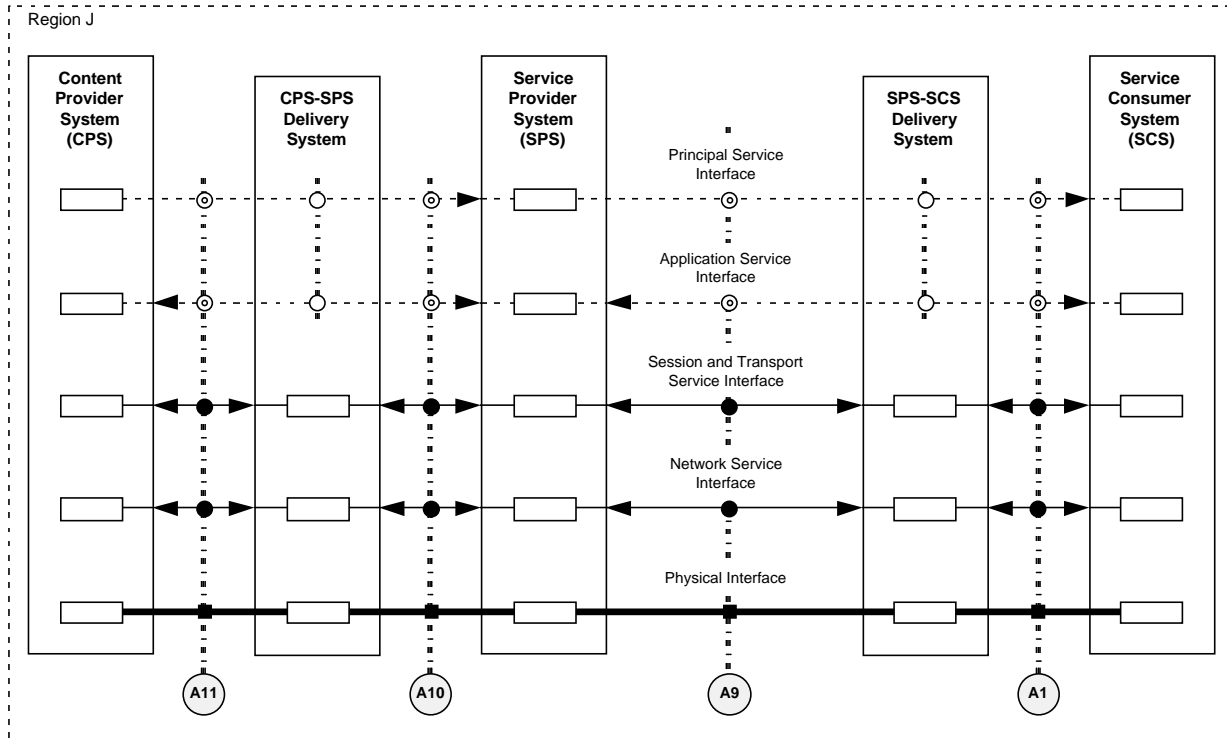


Figure 1. [The general DAVIC system](#)

In the analogue world all these systems were independently defined by groupings of companies (*industries*). This was quite natural because of the lack of flexibility of analogue technologies which favoured a tendency to keep services and applications tightly connected to the specific nature of delivery systems. This fact led to multiplication of devices, particularly in the users’ domain. The flexibility of digital technologies presents a unique possibility to overcome many of these problems and to realise end-to-end interoperability.

The DAVIC 1.2 Specifications have been developed based on the following guidelines.

1. **Openness of the specification process.** Although only DAVIC members are allowed to take part in DAVIC meetings, the specification development process provides total openness at two critical stages: when a request for technologies is issued, and later when specifications have reached sufficient maturity. Anybody is allowed to submit a response to a Call for Proposals, just as anybody is allowed to propose modifications to specifications which are made publicly available for comments. Of course DAVIC reserved the right to accept or reject a proposed technology or modification.
2. **Specification of “tools”.** DAVIC represents one of the most comprehensive systems integration activities ever undertaken. However, its main added value to the industries it serves comes from its focus and singular identification of tools. Typically the process of tool specification is carried out as follows:

- Analysis of target systems
- Breakdown of systems into components
- Identification of common components across systems
- Specification of all necessary components (tools)
- Verification that tools so defined can be used to assemble the target systems.

Therefore DAVIC-specified tools tend to be *non-system-specific* because they have to be usable by different industries in different systems.

3. **Relocation of tools.** Because DAVIC specifications have to satisfy business and service models of multiple industries, DAVIC tools need not only to be usable in a variety of different systems but also in different parts of the same systems. DAVIC defines its tools in such a way that they can be relocated, whenever this relocation is technically possible and practically meaningful.
4. **One functionality—one tool.** Tools should be unique, a principle sometimes hard to enforce, but compliance to this principle gives substantial benefits in terms of interoperability and availability of technology thanks to the easier achievement of a critical mass because of a wider field of applicability of the technology. Sometimes tools can contain normative improvements to specifications that do not affect backwards compatibility.
5. **DAVIC specifies the minimum.** In the case of specifications developed for a particular purpose in general there is no boundary between what is mandatory and what is added to it because it fits well in the particular application. A multi-industry environment like DAVIC can only produce specifications of tools with the minimum of detail that is needed for interoperability.

#### ***Nature of DAVIC specifications***

DAVIC specifications contain normative and informative parts. Normative parts have to be implemented as in the specifications in order to claim conformity of a subsystem to DAVIC Specifications. Informative parts are included as well for the purpose of clarifying the normative parts of the specifications and to give general assistance to implementors of specifications.

DAVIC specifications contain the reference model of the DAVIC system and its subsystems. DAVIC specifications also define reference points, i.e., points of particular interest in the system. These points have a normative value if they are accessible. Therefore a digital audio-visual subsystem conforms to DAVIC specifications if its accessible reference points do. This means that a subsystem can be considered as a black box and DAVIC specification conformity is only assessed at the external reference points.

DAVIC specifications define the technical *tools* whose use allows the provision of *functionalities* required by the DAVIC system and the applications that make use of it and with grades that determine the level of performance of a given tool, e.g., mono/stereo/multichannel audio, TV-HDTV, bandwidth of a return channel, etc. Definition of tools may also contain normative extensions that do not affect backwards compatibility.

DAVIC specifications are issued in versions: DAVIC 1.0, DAVIC 1.1, DAVIC 1.2, etc. DAVIC 1.0 which was published in January 1996, selected a set of tools for example which allowed specification of a common interface to most forms of network access, and a convergent view of end-to-end (user/user) signalling, including a download protocol. DAVIC 1.0 aimed to support basic applications such as TV distribution, near video on demand, video on demand and simple forms of teleshopping. DAVIC 1.1 added tools to support basic “Internet Compatibility”, the addition of MMDS and LMDS forms of access, network independent STU’s and STU’s which can behave as a Virtual Machine. Each future version will specify different grades of previously defined tools or more tools in addition to previously specified tools.

DAVIC specifications define only one tool per functionality. However, the exact definition and scope of a tool may change with time depending on the evolution of technology. For instance, at the current state of the art the tools for decoding audio or video at bit rates needed for entertainment-quality moving video require dedicated hard-wired processors. However, with the progress of technology it is quite likely that audio or video decoding at those bit rates will be done by generic processors which are easily reconfigurable under software control to decode a broad class of algorithms.

DAVIC specifications define tools in such a way that they can be relocated in different parts of the DAVIC system whenever this is technically feasible.

DAVIC specifications are developed by making use of the best available technologies or combinations thereof and as far as feasible are validated by technical interoperability tests. Because of the toolkit nature of the specifications, however, no claim can be made as to the suitability of DAVIC specifications or of any of its parts for any intended purpose of a user.

As a rule DAVIC specifications are accompanied by documents specifying methods to test the conformity of reference points to the specifications.

### ***Overview of DAVIC 1.2 Specification***

The structure of the DAVIC 1.2 Specification begins with applications, which are of course the driving factor for all players in the audio-visual industry. It then defines some essential vocabulary, and provides an initial Systems Reference Model as the basis for understanding and unifying the parts that follow. Two approaches are subsequently developed:

- Functional blocks and interfaces of the three major components of the audio-visual system (Service Provider System, Delivery System, and Service Consumer System) are described. Content creators and service providers are expected to favour this approach.
- A toolbox of: a) high and mid-layer protocol stacks, modulation, coding, and signalling techniques; and b) 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. Equipment vendors and system designers are expected to find this approach more appropriate to understanding DAVIC specifications.

Two other self-contained parts deal with representation of the audio-visual information and usage information gathering. These parts have more universal relevance to the component documents of the DAVIC 1.2 Specification.

**Summary of DAVIC 1.2 Specification parts**

<i>Part</i>	<i>Title</i>	<i>Major Sections</i>
Part 1	<b>Description of DAVIC Functionalities</b> (Technical Report)	Functionalities required to support DAVIC Applications Common Requirements of Applications and Services Descriptions of Example Applications
Part 2	<b>System Reference Models and Scenarios</b> (Technical Report)	Abstract System Reference Model DAVIC System Reference Model DAVIC System transaction flow scenarios Annexes : Supplementary definitions, Acronyms and abbreviations, Bibliography, Normative references and Interface examples.
Part 3	<b>Service Provider System Architecture and Interfaces</b> (Technical Report)	Architecture Service Interfaces Service Elements Networked Server Objects Informative Annexes : Conceptual Server Model, Service Provider Instance, Content Provision and VoD Scenario
Part 4	<b>Delivery System Architecture And Interfaces</b> (Technical Report)	The Delivery System Cabled networks Wireless networks Service Architecture Network and service related control Network and service management
Part 5	<b>Service Consumer System Architecture and High Level API</b> (Technical Specification)	Service Consumer System (Informative) STU Reference Points Run-time execution environment Annexes - Examples of DSM-CC file structure for an application, of mapping high level API actions on DSM-CC primitives, and of an OSI NSAP address format
Part 6	<b>Reserved</b>	
Part 7	<b>High and Mid-Layer Protocols</b> (Technical Specification)	S1 Flow : high and mid layer protocols S2 Flow : high and mid layer protocols S3 Flow : high and mid layer protocols S4 Flow : high and mid layer protocols S5 Flow : high and mid layer protocols Common protocols Connection block descriptors and initialisation protocols for A0 STU Dataport Annexes : STU MIB (Management Information Base) and Server MIB

<i>Part</i>	<i>Title</i>	<i>Major Sections</i>
Part 8	<b>Lower-Layer Protocols and Physical Interfaces</b> (Technical Specification)	<p>Tools for digitising the Core network</p> <p>Tools for digitising the Access network :-</p> <ul style="list-style-type: none"> <li>Low speed symmetrical physical layer interface (PHY) on the PSTN</li> <li>Low speed symmetrical PHY on the ISDN</li> <li>Low speed symmetrical PHY on public land mobile networks</li> <li>Long-range baseband asymmetrical PHY on copper</li> <li>Medium-range baseband asymmetrical PHY on copper</li> <li>Short-range baseband asymmetrical PHY on copper and coax</li> <li>Passband unidirectional PHY on coax</li> <li>Passband bi-directional PHY on coax</li> <li>Passband unidirectional PHY on satellite</li> <li>Passband unidirectional PHY on MMDS</li> <li>Passband PHY on LMDS</li> <li>Baseband symmetrical PHY on copper</li> <li>Baseband symmetrical PHY on fiber</li> </ul> <p>Network-Interface-Unit to Set-Top-Unit Interface (A0)</p> <p>STU Dataport Interface</p>
Part 9	<b>Information Representation</b> (Technical Specification)	<p>Monomedia components ( Character , Text , Language , Service , Telephone Numbers, Compressed &amp; Linear Audio, Compressed Video, Still Pictures, Uncompressed &amp; Compressed Graphics, Compressed Character Data )</p> <p>Monomedia streams</p> <p>Transport of monomedia streams and components</p> <p>Application Format ( Interchange Format, MHEG-5 profile , Set of Java API's, and mapping of MHEG Content Classes to monomedia content formats )</p> <p>DAVIC Reference Model for contents decoding</p> <p>Content packaging and Method data</p> <p>Annexes : Coding of linear audio, uncompressed graphics and compressed character data, packetization of monomedia components, stream representation of uncompressed graphics and compressed character data, definition of dsmccuu package, Carriage of private data, Video input format, STU Video decoding capabilities</p>
Part 10	<b>Basic Security for DAVIC</b>	<p>Security tools</p> <ul style="list-style-type: none"> <li>S1 Scrambling</li> <li>S2/S3 Authentication</li> <li>S2/S3 Confidentiality and Integrity</li> <li>S2 Digital Signatures</li> <li>DSM-CC Commands for S1 Security Management</li> <li>Secure Download</li> <li>Parental Control</li> </ul> <p>Flows and protocol stacks</p> <p>Security Interfaces :</p> <p>Security Interface CA0</p> <p>Normative Annexes (profiles/contours, Security Interface CA1, Additional resources for the DAVIC CA0 interface, Methodology)</p>

<i>Part</i>	<i>Title</i>	<i>Major Sections</i>
Part 11	<b>Usage Information Protocols</b> (Technical Specification)	Usage information : - Purpose - Telecommunications Management Network (TMN) Usage Data Functions (Usage Data Generation, Accumulation, Validation, Assembly, Formatting, Correlation Support and Collection Administration ) Architecture Usage data collection element DAVIC system manager Usage data collection interface Usage data transfer interface
Part 12	<b>Reference Points, Interfaces and Dynamics</b> (Technical Specification)	Requirements for DAVIC Compliant systems Implementation procedure Instance Development Tool DAVIC System dynamic modelling Configuration : Configuration (Boot) STU and Service Provider Configuration Download Specification of the usage of DAVIC protocol tools Annex : Rationale behind the selection of the DAVIC 1.2 specification dynamic systems behaviour
Part 13	<b>Conformance and Interoperability</b>	Testing and verification Testing of systems Testing of technology tools Testing of protocols

### ***How to use this Specification***

It may be helpful to briefly indicate how designers of different parts of the audio-visual system might use the DAVIC 1.2 Specification—a kind of route map to implementors in terms of which parts of the Specification are relevant to their task, and how to proceed. Implementors will typically include Content Providers, Service Providers and Network Operators, and Designers or Manufacturers of servers, set-tops and delivery system components.

#### **1. Guidance to Content Creators**

Part 9 defines what the user will eventually see and hear and with what quality.

Part 5 outlines the actions that can take place with the tools and the kinds of objects and elements of Part 9.

Part 3 defines how to load an application, once created, onto a server.

Part 1 gives introductory guidance on what kind of applications are supported by DAVIC 1.2 and identifies the functionalities which must be provided.

Part 11 relates to formats for the collection of usage data.

#### **2. Guidance to Service Providers**

Part 3 is the principal source of information on server architecture. Part 9 defines how information is presented to end-users. Together, these two parts define the *core* DAVIC services that determine what the user actually sees and hears. Part 3 also gives guidance on the protocols in Part 7, transmitted from the set-top user to the server, used to control the set-up and execution of a selected application.

Usage data collected as defined in Part 11 can be used for billing, and other business-related operations such as customer profile maintenance.

Part 8 specifies the delivery system requirements for the server with relevant information in Part 4.

#### **3. Guidance to implementors of sub-systems**

A digital audio-visual subsystem conforms to DAVIC specifications if its accessible reference points do. Purchasers or designers/manufacturers of set-tops, servers, delivery systems, etc., seeking to be sure of, or to claim compliance to the DAVIC 1.2 Specification, can therefore check against the appropriate reference point(s) A1, A4, A9, or A10 defined in Parts 7 and 8.

Instantiations of the protocols specified in Part 12 may also illustrate the detailed conformance required in order that a given sub-system will correctly reflect the characteristics of the rest of the DAVIC system at each relevant reference point.

Parts 5, 3, and 4, respectively, define the requirements for set-top, server and delivery-system architectures, and provide frameworks for the *toolbox* of all protocols listed in Parts 7 and 8.

## 1. SCOPE

Part 5 of this Specification provides both an informative description of the components of an SCS and outlines the normative parts of an SCS. The reference point interfaces A0, A1, RP2 and RP4 and the MHEG-5 namespace are defined to be normative and the reference points RP3, RP5 and RP7 are not defined as normative in DAVIC 1.2.

## 2. NORMATIVE REFERENCES

The following documents contain provisions which through reference in this text, constitute provisions of this Specification. At the time of publication, the editions indicated were valid. All referenced documents are subject to revision, and parties to agreements based on this Specification are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau (TSB) maintains a list of currently valid ITU-T Recommendations.

ISO/IEC 13522-5: *Information technology - Coding of multimedia and hypermedia information - Part 5: Support for base-level interactive applications*

ISO/IEC 13818: *Information Technology - Generic Coding of Moving Pictures and Associated Audio information*

ISO/IEC 14750-1: *Interface Definition Language*

## 3. DEFINITIONS

This Section defines new terms, and the intended meaning of certain common terms used in this Specification. Part 2 [Annex A](#) defines additional terms and, in some cases, alternative interpretations that are appropriate in other contexts. The definitions in the annex were derived from various sources: some are direct quotes, others have been modified. Supplementary definitions in Part 2 [Annex A](#) are not normative and are provided for reference purposes only. (For convenience, copies of the normative definitions below are included in the annex.)

For the purposes of this Specification, the following definitions apply.

### **application:**

A set of objects according to the definition of the high-level API.

### **ContentData:**

Data in a format for representing the object (e.g. video object's content data is MPEG-2 stream data).

### **MHEG-5 class:**

The abstract definition of exchanged and internal attributes of parts of interchangeable multimedia / hypermedia objects. It also defines the semantics of internal behaviours and the effect of MHEG-5 actions for these objects.

### **MHEG-5 object:**

An instance of an [MHEG-5 class](#). An MHEG-5 object is not a physical object, but rather an abstraction that may have many representations of different types. Various software services handle such representations.

## 4. ACRONYMS AND ABBREVIATIONS

Part 2 [Annex A](#), B and C contain a complete set of acronyms and abbreviations used throughout the [DAVIC 1.2](#) Specification. The following acronyms and abbreviations are used in this Specification:

API	Application Program Interface
ASCII	American Standard Code for Information Interchange
ASN.1	Abstract Syntax Notation 1
DSM-CC U-U	Digital Storage Media - Control Commands User-User
DSM-CC U-N	Digital Storage Media - Control Commands User-Network
ECM	Entitlement Control Message
HMSC	Human Machine Service Consumer
IEC	International Electrotechnical Committee
IDL	Interface Definition Language
ISO	International Organization for Standardization
ITU-T	International Telecommunication Union - Telecommunication Sector

MHEG-5	Multimedia and Hypermedia information coding Expert Group - Part 5. Support for base-level interactive applications
NIU	Network Interface Unit
RPC	Remote Procedure Call
RTE	RunTime Engine
SCS	<a href="#">Service Consumer System</a>
TS	Transport Stream
TSB	Telecommunication Standardization Bureau
TV	Television
UNO	Universal Networked Object
VCR	Video Cassette Recorder

## 5. CONVENTIONS

The style of this Specification follows the general guidelines of ISO/IEC 0001 : 1993: Information Technology Rules For Presentation Of ITU-T | ISO/IEC Common Text.

## 6. SERVICE CONSUMER SYSTEM (INFORMATIVE)

The following diagram of the [Service Consumer System](#) reference model is first found in [section 2](#) along with modules that are commonly found in an SCS. This section is informative for the purpose of showing one possible implementation of the DAVIC reference model. This section in no way defines how an SCS has to be implemented. The described modules in the diagram can be divided and combined in any way that an implementor desires. The only requirements for the SCS is that the normative reference points meet the defined specification outlined in [Section 7](#).

In this example the NIU, Settop Unit and Human Machine Service Consumer are different physical devices. Also the Human Machine Service Consumer is a display or storage device (e.g. TV, Digital Video Tape Recorder, etc.). This is just one example. The Human Machine Service Consumer could just as easily have been a VCR or the STU and NIU could be one physical unit.

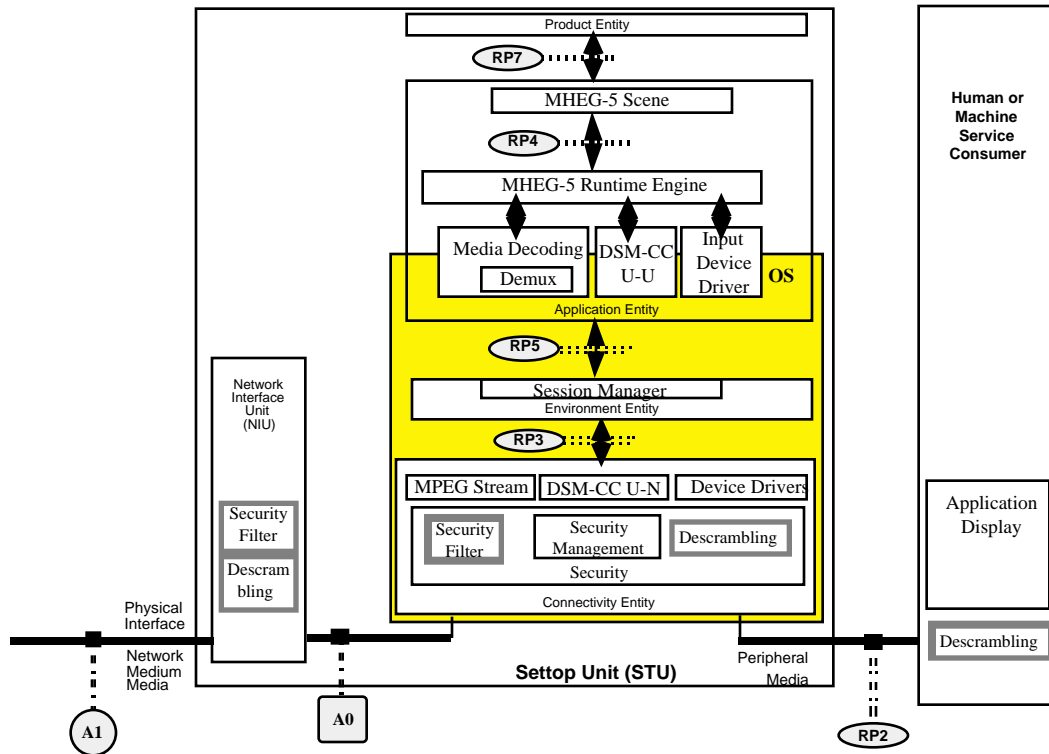


Figure 6-1. Informative diagram of SCS Reference Model with an example of common modules found in commercial SCS's

Table 6-1. Module explanation for Figure 5-1 of SCS system

COMPONENT	DESCRIPTION
NIU	This is the network dependent interface between a DAVIC network and a DAVIC STU.
STU	This is the main unit that is responsible for receiving, interpreting and formatting information correctly to be displayed, as in the example, on the HMSC.
Connectivity Entity	This is the entity that deals with the low level connectivity between STU and the server as well as the communication between the STU and HMSC. The sub components are listed below.
DSM-CC U-N	This is the User to Network communication module defined in DSM-CC.
MPEG Stream	This is the stream (video and audio) transport mechanism.
Device Driver	This is the driver responsible for sending the display information to the HMSC.
Security	This module represents the security functions for the <a href="#">service consumer system</a> . It is divided into 3 parts: security management, security filter and descrambling. These components are explained below.

Security Management	This module manages secure session negotiation, scrambling algorithm negotiation (or identification in a 1-way broadcast environment), authentication (1-way and 2-way), and secure transactions (e.g. payment).
Security Filter	This module extracts ECM messages and forwards them to the Security Management module. This module is represented as possibly being in two places (NIU or STU).
Descrambling	This module makes intelligible scrambled data upon receiving appropriate descrambling keys from the Security Management. This module is represented as possibly being in two places (STU, NIU or HMSC).
<i>Environment Entity</i>	This entity deals with session setup for the STU.
Session manager	This module sets up and manages the session.
<i>Application Entity</i>	This entity deals with the running of an application and all the underlying components needed for the applications. The sub components are listed below.
Media Decoding	This decodes and manipulates all the media that is transferred to the system (e.g. MPEG, Bitmap, Text, Audio, etc.) This is where the Demux of MPEG2-TS stream is also done.
DSM-CC U-U	This is where all the RTE request are translated to DSM-CC User to User messages.
Input Device Driver	This is the device driver that handles the events from the user input device.
MHEG-5 Runtime Engine	This is the entity that interprets the MHEG-5 data to run an application.
OS	This is the general operating system of the STU.
<b>Human Machine Service Device</b>	In the above example this is the TV set.
Application Display	This is the software/hardware component that displays and plays the presentable parts of an application.

## 7. STU REFERENCE POINTS

The normative parts of the [Service Consumer System](#) are defined at the reference points and must exist to be DAVIC compliant. The interfaces defined at the reference points can be implemented in software and need not always be physically present in the SCS. These interfaces can be achieved by downloading the appropriate software components partially or wholly prior to when they are needed. DAVIC compliance can only be achieved if [DAVIC+1.2](#) applications can successfully execute once all the interface components are present in the system.

The reference points that have been defined for [DAVIC+1.2](#) are A0, A1, RP2 and RP4. The reference points RP3 and RP7 have not been defined for [DAVIC+1.2](#). The table below shows the reference points and the corresponding location of the normative definition for that point.

Table 7-1. Service Consumer System Normative Table

Reference Point	Location of Normative Definition
A0 (implemented if NIU and STU are physically distinct)	Part 12 Clause 10.3
A1	Part 12 Clause 10.4

RP2-Video Interface	The Video interface will support both baseband 625/25 and baseband 525/29.97, when a 525/29.97 signal (encoded) is delivered to the STU the STU shall produce a baseband 525/29.97 output, when a 625/25 signal (encoded) is delivered to the STU the STU shall produce a baseband 625/25 output.
RP2-Audio	2 channel audio
RP2-others	Not defined in <a href="#">DAVIC†1.2</a>
RP4-Application Interface	Part 9.9: Pointer to MHEG-5 specifications
RP4-Data Types	Part 9.9.5: Data type supported by STU mapped to <a href="#">MHEG-5 object</a> content data
RP3	Not Defined in <a href="#">DAVIC†1.2</a>
RP5	Not Defined in <a href="#">DAVIC†1.2</a>
RP7	Not Defined in <a href="#">DAVIC†1.2</a>

## 8. RUN-TIME EXECUTION ENVIRONMENT

### 8.1 Application execution

The STU [run-time execution environment](#) shall include the following components:

- the MHEG-5 run-time engine, as defined by ISO/IEC 13522-5; the MHEG-5 run-time engine shall be extended by supporting MHEG-5/Java VM interworking provisions as defined by ISO/IEC 13522-6;
- implementation of the Java virtual machine, as specified by the *Java Virtual machine specification*;
- implementation of the following Java packages: `java.lang`, `java.util`, `iso.mheg5`, `davic.dsmccuu`, `davic.CosNaming`, `davic.CosNaming.NamingContext_`.

The MHEG-5 run-time engine shall fully support the MHEG-5 instantiation defined by part 9 of this Specification.

### 8.2 User Input Events

The application domain specifies `UserInputEventRegisters` (see part 9 subclause 9.2.5). Each register has a number, which is exchanged as one of the parameters of a Scene object. The contents of a `UserInputEventRegister` (which is not exchanged) is a set of numbers (representing `UserInputEventTags`) and a name. The name/number pairs bind a specific `UserInputEventTag` to a logical input event. It is the task of the engine implementor to bind the logical input event to one or more physical input events. The table in part 9 subclause 9.2.5 specifies the mandatory user input events that have to be generated by the user device for [DAVIC†1.2](#) STUs. Connection management

The MHEG-5 actions `OpenConnection` and `CloseConnection` take the parameters Protocol and Address. These map as follows to the protocols specified by [DAVIC†1.2](#):

Table 8-1.

<i>Parameter</i>	<i>Encoding</i>	<i>Semantics</i>
Protocol	One of the following strings: “PSTN”  “ISDN”	The connection shall be made over a PSTN network.  The connection shall be made over an ISDN network.
Address	For PSTN: E.164 <i>NSAP</i> For ISDN: E.164 <i>NSAP</i>	This is the address of the network service access point <i>and</i> the internet address of the service gateway to attach to. For the encapsulation of the internet address, the ATM forum specification is used.

### 8.3 IDL definition for RTE run remote call

MHEG-5 RemoteProgram objects invoke a stub at the client side. That stub then sends a DAVIC-defined message to the server, using the remote procedure call protocol defined in Part 7. The IDL definition of the stubs is as follows:

```

module DAV
{
    enum parType {boolPar, intPar, octStringPar, objRefPar, contRefPar};
    typedef sequence<octet> octString;
    typedef struct oR {
        octString groupIdentifier;
        long objectNumber;
    } objRef;
    typedef octString contRef;
    union par switch (parType)
    {
        case boolPar: boolean aBoolean;
        case intPar: long anInt;
        case octStringPar: octString aString;
        case objRefPar: objRef anObjRef;
        case contRefPar: contRef aContRef;
    };
    typedef sequence<par> pars;
    interface MHEG {
        void call(
            in octString programName,
            inout pars somePars
        );
        void fork(
            in octString programName,
            inout pars somePars
        );
    };
};

```

The mapping of the parameters of the MHEG-5 actions Call and Fork is intuitive. It is the responsibility of the MHEG engine to set the MHEG-5 parameters ForkSucceeded and CallSucceeded, respectively, to indicate the success or failure of the RPC operation

## ANNEX A

### EXAMPLE OF DSM-CC FILE STRUCTURE FOR AN APPLICATION

(This annex does not form an integral part of this document.)

This is an example to show how things are named in an application. The diagram below is a logical DSM-CC file structure along with the object references for an application object file, a scene object file and content data files.

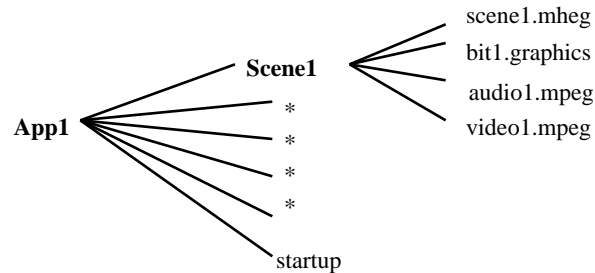


Figure A-1. DSM-CC file structure example

Below is a code fragment for accessing the different objects depicted in the figure above.

```

{:application
  ("App1/startup" 0)}
{:scene
  ("App1/Scene1/scen1.mhcg" 0)
  :Items (
  {:bitmap 1
    (:content "App1/Scene1/bitmap.graphics") ...}
  {:audio 2
    (:content "App1/Scene1/audio1.aiff") ...}
  {:video 3
    (:content "App1/Scene1/video1.mpeg") ...}
  ...))

```

## ANNEX B

**EXAMPLE OF MAPPING HIGH-LEVEL API ACTIONS ON DSM-CC PRIMITIVES**

(This annex does not form an integral part of this document.)

This specification does not normatively define how the actions in the high-level API map to DSM-CC primitives. But below is a table of possible DSM-CC mapping to the high level API. This will give the reader a better understanding of how DSM-CC primitives can be used to implement an MHEG-5 runtime engine. Again, this is only an example.

<i>MHEG-5 Behavior</i>	<i>Object Type</i>	<i>DSM-CC U-U Function</i>
Launch/Spawn	Application	DirectoryOpen( <i>app.fileid</i> ) -> <i>FileObRef</i> FileRead( <i>FileObRef</i> )
Prepare	Scene, content object and stream	DirectoryOpen( <i>scene.fileid</i> ) -> <i>FileObRef</i> FileRead ( <i>FileObRef</i> )
Run	Video and Audio	DirectoryOpen( <i>stream.file</i> ) -> <i>StreamObRef</i> StreamResume( <i>StreamObRef</i> , <i>starttime</i> , <i>I/I</i> )
Stop	Stream	StreamPause( <i>StreamObRef</i> , <i>x80000</i> )
StreamMarker	Stream	StreamSubscribe ( <i>StreamObRef</i> , <i>marker</i> ) StreamNotify ( <i>StreamObRef</i> , <i>marker</i> , <i>call back function</i> ) StreamUnSubscribe ( <i>StreamObRef</i> , <i>marker</i> )
StreamTimer	Stream	StreamStatus -> Gets normal playtime
Stream Looping	Stream	This is still being discussed by DSM-CC
FreezeFrame	Video	
RunAsynchronous and RunSynchronous	Application	RPC - UNO
OpenConnection	Application	Attach ( <i>ID</i> )

## ANNEX C

### EXAMPLE OF AN OSI NSAP ADDRESS FORMAT

(This annex does not form an integral part of this document.)

#### Purpose

The purpose of this annex is to describe a possible implementation for `clientId` and `serverId`, two User-to-Network message data fields used in many of the User-to-Network messages. The normative section of this specification defines these fields to be in the format of an OSI NSAP (Network Service Access Point) address. For more details on `clientId` and `serverId`, refer to the section on User-to-Network Messages.

#### Introduction

ISO/IEC 8348 defines the [OSI NSAP address formats](#). The ATM Forum industry consortium uses a subset of these address formats -- named AESA (ATM End System Address) -- in the User-Network Interface (UNI) Specification. The example selected below is the E.164 NSAP.

Note: Any discrepancies between the OSI and ATM Forum specifications, and the address format described below represents an error in the format presented here.

#### E.164 NSAP

While any AFI is acceptable for DSM-CC (i.e., inter-networking is beyond the scope), an example is the E.164 version of the AESA address format. The characteristics of this format are as follows:

The generic OSI NSAP address consists of two domains:

1. I. Initial Domain Part (IDP), which consists of two sub-parts:
  2. A. 1-byte Authority and Format Identifier (AFI)
  3. B. A variable-length Initial Domain Identifier (IDI), which depends on the value of the AFI.
4. II. Domain Specific Part (DSP) which depends on the value of the IDI.

The E.164 NSAP version is a fixed 20-byte OSI NSAP address and is formatted as follows:

IDP		DSP		
IDI				
AFI	E.164	HO-DSP	ESI	SEL
1-byte	8-byte	4-byte	6-byte	1-byte

where

Total length: 20 bytes  
 AFI: 45 (ISO/IEC 8348 registered)  
 IDI: 8-byte BCD-encoded E.164 address

DSP: Contains the Internet Protocol (IP) address in the 4-byte High Order-DSP (HO-DSP), the MAC address in the 6-byte End System Identifier (ESI), and a subscriber's identifier in the 1-byte Selector (SEL).

For Clients, the E.164 address in the IDI identifies an ATM-to-the-curb drop. The MAC address identifies the set-top terminal that is serviced by the drop. The SEL byte allows the set-top terminal to support up to 256 logical subscribers from one hardware platform, such as in a dormitory environment where one terminal may be shared by more than one roommate.

For servers, the E.164 address identifies the ATM address of the server. The ESI identifies a service that runs in that server.

IP addresses can be embedded within the above format to be used by the interactive multi-media applications between the Client and Server (User-to-User communication).