
**Information technology — Coding of
multimedia and hypermedia information —
Part 6:
Support for enhanced interactive applications**

*Technologies de l'information — Codage de l'information multimédia et
hypermédia —
Partie 6: Support pour les applications interactives améliorées*

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Contents

1	Scope	1
1.1	Context of the scope	1
1.2	Scope of this part of ISO/IEC 13522	1
2	Normative references	2
2.1	International standards	2
2.2	Referenced specifications	3
3	Terms and definitions	3
3.1	applet	3
3.2	application class	3
3.3	application programming interface (API)	3
3.4	attribute	3
3.5	class	3
3.6	exception	3
3.7	hypermedia, adj	3
3.8	instance	3
3.9	interface	4
3.10	Java™ Virtual Machine (JVM)	4
3.11	method	4
3.12	MHEG-5 API	4
3.13	MHEG-5 InterchangedProgram object	4
3.14	MHEG-5 object	4
3.15	MHEG-6, adj.	4
3.16	MHEG-6 Applet object	4
3.17	MHEG-6 application	4
3.18	MHEG-6 engine	4
3.19	MHEG-6 InterchangedProgram object	4
3.20	MHEG-6 object	4
3.21	MHEG-6 profile	4
3.22	MHEG-6 program	4
3.23	multimedia, adj.	5
3.24	multimedia and hypermedia application	5
3.25	multimedia application	5
3.26	operation	5
3.27	program	5
3.28	Program content interchange format	5
3.29	scripting language	5
3.30	stack	5
3.31	system class	5
3.32	virtual machine (VM)	5

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4	Symbols and abbreviations	5
5	Conformance requirements.....	6
5.1	Information object conformance	6
5.1.1	Encoding and syntax	6
5.1.2	Semantics.....	6
5.1.3	Profiles	6
5.2	Implementation conformance	6
5.2.1	Conformance requirements.....	6
5.2.2	Conformance documentation	7
5.3	Application conformance	7
6	Structure of this part of ISO/IEC 13522.....	8
7	MHEG-6 InterchangedProgram class	9
7.1	InterchangedProgram object syntax	9
7.1.1	Syntax of InterchangedProgram class	9
7.1.1.1	Name attribute	9
7.1.1.2	OriginalContent attribute.....	9
7.1.1.3	ContentHook attribute.....	9
7.1.1.4	Shared attribute	9
7.1.2	Syntax of elementary actions applicable to InterchangedProgram objects.....	10
7.2	InterchangedProgram object semantics	10
7.2.1	InitiallyAvailable attribute	10
7.2.2	Scope of InterchangedProgram objects	10
7.2.3	Effect of elementary actions applicable to InterchangedProgram objects	11
7.2.3.1	Preparation behaviour	11
7.2.3.2	Activation behaviour	11
7.2.3.3	Deactivation behaviour	12
7.2.3.4	Destruction behaviour	12
8	Applet class	13
8.1	Attributes.....	13
8.1.1	Inherited attributes.....	13
8.1.2	Own exchanged attributes.....	13
8.1.3	Own internal MHEG-5 attributes	13
8.2	Events	14
8.3	Internal behaviours	14
8.4	Effect of MHEG-5 elementary actions	15
8.5	Formal description	17
9	Virtual machine.....	18
9.1	VM instruction set	18
9.2	VM interchange format	18
10	Kernel API	19
10.1	Specification of the kernel API	19
10.2	Syntax requirement.....	19
10.3	Semantics requirement.....	19
10.4	Pragmatics requirement.....	19
11	MHEG-5 API.....	20
11.1	Specification of the MHEG-5 API.....	20
11.1.1	Design principles	20
11.1.2	Grades.....	20
11.2	Syntax requirement.....	21
11.3	Semantics requirement.....	21
11.4	Pragmatics requirement.....	21
11.5	Interworking considerations	21

12	MHEG-5/JVM interworking provisions	22
12.1	Program content interchange format	22
12.2	Semantics of elementary actions	22
12.2.1	Call	22
12.2.2	Fork	2 3
12.2.3	Invoke	23
12.2.4	Stop	2 3
12.2.5	MHEG-5 API operations	23
12.3	Execution semantics	23
12.3.1	Engine bootstrapping	24
12.3.2	ClassMapper initialisation	24
12.3.3	Program preparation	25
12.3.4	Program activation	25
12.3.5	Program deactivation	25
12.3.6	Program destruction	25
12.3.7	ClassMapper for Applet	26
Annex A (normative) ASN.1 notation		27
Annex B (normative) Textual notation		45
Annex C (normative) MHEG-5 API		60
Annex D (informative) Mapping elementary actions to MHEG-5 API operations		77
Annex E (informative) Relationships between MHEG-6 Applets and World Wide Web applets		81
Annex F (informative) Main features		82
Annex G (informative) IPR issues		87

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Foreword

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

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.

International Standard ISO/IEC 13522-6 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 13522 consists of the following parts, under the general title *Information technology - Coding of multimedia and hypermedia information*:

- Part 1: MHEG object representation - Base notation (ASN.1)
- Part 3: MHEG script interchange representation
- Part 4: MHEG registration procedure
- Part 5: Support for base-level interactive applications
- Part 6: Support for enhanced interactive applications
- Part 7: Interoperability and conformance testing for ISO/IEC 13522-5

Annexes A to C form an integral part of this part of ISO/IEC 13522. Annexes D to G are for information only.

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Information technology – Coding of multimedia and hypermedia information –

Part 6: Support for enhanced interactive applications

1 Scope

1.1 Context of the scope

ISO/IEC 13522 specifies the coded representation of multimedia/hypermedia information objects (MHEG objects) for interchange as final form units within or across services and applications, by any means of interchange including local area networks, wide area telecommunication or broadcast networks, storage media, etc.

MHEG objects can be produced by computer tools taking as source form multimedia applications designed using multimedia scripting languages. In this context, the MHEG script (or program) classes are intended to complement the other MHEG classes in expressing the functionality commonly supported by scripting languages. Script (or program) objects express more powerful control mechanisms and describe more complex relationships among MHEG objects than can be expressed by MHEG action and link objects alone. Furthermore, script (or program) objects express access to and interaction with external services provided by the run-time environment.

ISO/IEC 13522-5 defines the MHEG object classes for interchange and use in base-level applications intended to be run on limited resource terminals such as set-top-boxes in such contexts as interactive broadband services.

ISO/IEC 13522-5 defines the coded representation for program objects in an open manner so that program objects may encapsulate either standardised or proprietary program code. ISO/IEC 13522-5 allows program objects to include or reference programs that may be encoded in any encoding format as defined by the application domain.

1.2 Scope of this part of ISO/IEC 13522

The scope of this part of ISO/IEC 13522 is to define the semantics and final-form coded representation for the interchange of enhanced interactive multimedia applications.

These applications extend applications covered by ISO/IEC 13522-5 in incorporating functionality such as computing (data processing) and extended communication with the external environment, including servers, local devices, etc.

These applications may be exploited in any communication environment including broadcast-only mode, interactive client-server or peer-to-peer (conversational). However, the main focus is on interactive retrieval (client-server) applications running on limited resource set-top-units involving asymmetrical data interchange with real-time audiovisuals on the downstream channel.

The coded representation defined by this part of ISO/IEC 13522 specialises the coded representation defined by ISO/IEC 13522-5. Especially, this part of ISO/IEC 13522 defines the coded representation for the OriginalContent attribute of the MHEG-5 InterchangedProgram class. In addition, this part of ISO/IEC 13522

defines the Applet class; this subclass of InterchangedProgram features the ability to manage its own display and interaction, by delegation from the engine.

The resulting coded representation is

- compatible with that defined by ISO/IEC 13522-5;
- appropriate for execution on a set-top-unit with the same minimal resource constraints as expressed by ISO/IEC 13522-5.

This part of ISO/IEC 13522 specifies

- the interchange format for the OriginalContent attribute of the MHEG-5 InterchangedProgram class;
- the semantics of this coded representation;
- the coded representation and semantics of the Applet class;
- the semantic extensions to the MHEG-5 engine behaviour described by ISO/IEC 13522-5;
- the semantic restrictions on the MHEG-5 interchange format described by ISO/IEC 13522-5;
- the MHEG-5 API, which allows the code of an InterchangedProgram object to call upon the MHEG-5 engine's presentation functionality;
- the provisions for interworking between the MHEG-5 engine execution model and the execution model that underlies the program content interchange format.

MHEG engines are system or application components that handle, interpret and present MHEG objects. This part of ISO/IEC 13522 specifies the semantics of the MHEG-6 coded representation. These semantics are defined in terms of minimum requirements on the behaviour of MHEG-6 engines.

This part of ISO/IEC 13522 is applicable to all applications that interchange multimedia and hypermedia information.

2 Normative references

2.1 International standards

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 13522. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 13522 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC 646:1991, *Information technology - ISO 7-bit coded character set for information interchange*.

ISO/IEC 8824-1:1995, *Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation*.

ISO/IEC 8825-1:1995, *Information technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*.

ISO/IEC 10646-1:1993, *Information technology - Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane*.

ISO/IEC 13522-5:1997, *Information technology - Coding of multimedia and hypermedia information - Part 5: Support for base-level interactive applications.*

2.2 Referenced specifications

All references in this subclause were correct at the time of approval of this part of ISO/IEC 13522. The provisions of the referenced specifications, as identified in this subclause, are valid within the context of this part of ISO/IEC 13522. The reference to a specification within this part of ISO/IEC 13522 does not give it any further status within ISO/IEC; in particular, it does not give the referenced specification the status of an International Standard.

Lindholm, Tim and Yellin, Frank (September 1996), *The Java™ Virtual machine specification*. ISBN: 0-201-63452-X, Addison-Wesley Publishing Co.: Reading, Massachusetts.

Gosling, James, Yellin, Frank and the Java team (May 1996), *The Java™ Application Programming Interface, Volume 1: Core Packages*. ISBN: 0-201-63453-8, Addison-Wesley Publishing Co.: Reading, Massachusetts.

3 Terms and definitions

For the purposes of this part of ISO/IEC 13522, the terms and definitions given in ISO/IEC 13522-5 and the following terms and definitions apply.

3.1 applet

autonomous program that can be run only within a host framework

3.2 application class

JVM class entirely implemented in JVM code and interchanged as part of an MHEG-6 application

3.3 application programming interface (API)

boundary across which a software application uses facilities of programming languages to invoke software services

3.4 attribute

named, typed association between an object and a value, declared as part of the interface of a class:

- a) MHEG-5 attribute (see ISO/IEC 13522-5);
- b) attribute of a JVM class (see 2.2)

3.5 class

abstract definition of the data (attributes) and behaviours common to a set of interchanged information objects:

- a) MHEG-5 class (see ISO/IEC 13522-5);
- b) JVM class (see 2.2)

3.6 exception

signal that is raised when an exceptional condition occurs during the performance of the request to an operation; especially, JVM exception (see 2.2)

3.7 hypermedia, adj.

featuring access to monomedia and multimedia information by interaction with explicit links

3.8 instance

object that features the attributes and behaviours of a specified class

3.9 interface

description of a set of operations that a client may request of an object:

- a) application programming interface;
- b) JVM interface (see 2.2)

3.10 Java™¹ Virtual Machine (JVM)

the virtual machine defined by *The Java™ Virtual machine specification* (see 2.2), used as the interchange representation and execution model for the OriginalContent attribute of MHEG-6 InterchangedProgram objects

3.11 method

operation defined by a class; especially, JVM method (see 2.2)

3.12 MHEG-5 API

the API that defines the byte codes used by the OriginalContent of an MHEG-6 InterchangedProgram to access the attributes and control the behaviour of MHEG-5 objects

3.13 MHEG-5 InterchangedProgram object

MHEG-5 object that provides means to invoke a processing unit represented as interpreted or executable code consisting of sequences of instructions

3.14 MHEG-5 object

coded representation of an instance of an MHEG-5 class

3.15 MHEG-6, adj.

conforming to the provisions of this part of ISO/IEC 13522

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3.16 MHEG-6 Applet object

instance of the Applet class defined in Clause 8 [ISO/IEC 13522-6:1998](https://standards.iteh.ai/catalog/standards/sist/d8ccae6c-9762-4e65-8e3f-430cb8031c38/iso-iec-13522-6-1998)

3.17 MHEG-6 application

application that involves the interchange, within itself or with another application, of MHEG-5 objects and of programs as the OriginalContent attribute of MHEG-5 InterchangedProgram objects, according to the representation defined by this part of ISO/IEC 13522

3.18 MHEG-6 engine

process or set of processes that can interpret MHEG-6 objects (including JVM programs) according to the provisions of this part of ISO/IEC 13522

3.19 MHEG-6 InterchangedProgram object

MHEG-5 InterchangedProgram object that conforms to the provisions of this part of ISO/IEC 13522

3.20 MHEG-6 object

MHEG-5 object that conforms to the semantic extensions defined by Clause 7, or object of the Applet class defined by Clause 8

3.21 MHEG-6 profile

profile of this part of ISO/IEC 13522

3.22 MHEG-6 program

list of JVM classes that are included or referenced by the OriginalContent attribute of an MHEG-6 InterchangedProgram object

¹ Java is a trademark owned by Sun Microsystems, Inc.

3.23 multimedia, adj.

that handles several types of representation media

3.24 multimedia and hypermedia application

application that features presentation of multimedia information to the user and interactive navigation across this information by the user

3.25 multimedia application

application that features presentation of multimedia information to the user

3.26 operation

service that can be requested and is provided by an object; it is defined within an interface by a name, a signature which defines the type of its parameters and return value, and the list of exceptions that its invocation may raise

3.27 program

sequence of binary codes that express computing behaviour and that can be run in an appropriate computer environment to effect this behaviour

3.28 Program content interchange format

the syntax and encoding for the OriginalContent attribute (when of the IncludedContent type) of an MHEG-6 InterchangedProgram, as defined in 12.1

3.29 scripting language

programming language intended for easy and rapid design of applications by non-professional programmers

3.30 stack

collection of elements that are inserted (pushed) and removed (popped) in last-in first-out (LIFO) order

3.31 system class

JVM class whose implementation is (at least partly) system-dependent (so consists of native code) and therefore must be available within the runtime environment for use by the VM

3.32 virtual machine (VM)

abstract specification of a micro-processor and its behaviour

NOTE A VM may be implemented on different hardware processors. A VM therefore implements the mechanism for all these processors to execute the same instruction set. It is also possible for a micro-processor to be designed so that its instruction set is identical to that of a VM. VM code can be used to make software portable.

4 Symbols and abbreviations

For the purposes of this part of ISO/IEC 13522, the following symbols and abbreviations apply.

API	Application Programming Interface
ASN.1	Abstract Syntax Notation One
ETSI	European Telecommunications Standards Institute
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
ITU-T	International Telecommunication Union, Telecommunication standardisation sector
JVM	Java™ Virtual Machine
HTML	HyperText Mark-up Language
MHEG	Multimedia and Hypermedia information coding Experts Group
VM	Virtual Machine
WWW	WorldWide Web

5 Conformance requirements

This part of ISO/IEC 13522 defines conformance requirements

- on information objects, i.e. MHEG-6 objects;
- on implementations, i.e. MHEG-6 engine implementations.

5.1 Information object conformance

A conforming MHEG-6 object shall meet all of the following criteria:

- its encoding and syntax shall conform to the provisions referred to by 5.1.1;
- its semantics shall conform to the provisions referred to by 5.1.2.

The information object conformance is evaluated on the information objects that are interchanged for the purpose of their execution on a terminal.

5.1.1 Encoding and syntax

A conforming MHEG-6 object shall be encoded according to either the encoding rules and the syntax defined by Annex A, or those defined by Annex B.

Moreover, the attributes of a conforming MHEG-6 InterchangedProgram object shall follow the syntax and encoding provisions specified by 7.1.

5.1.2 Semantics

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A conforming MHEG-6 object shall only include semantically valid constructs as defined by ISO/IEC 13522-5 and by Clauses 7 to 12 of this part of ISO/IEC 13522.

5.1.3 Profiles

This part of ISO/IEC 13522 defines no profiles.

5.2 Implementation conformance

An implementation of this part of ISO/IEC 13522 is an MHEG-6 engine.

This part of ISO/IEC 13522 defines the semantics of MHEG-6 objects. This implies conformance requirements not on information objects, but on the behaviour of MHEG-6 engines.

5.2.1 Conformance requirements

Conformance of MHEG-6 engines can only be measured with regard to an application domain definition, as defined by Clause 4 of ISO/IEC 13522-5.

In addition to all of the mandatory classes listed in Clause 4 of ISO/IEC 13522-5, any MHEG-6 engine shall interpret the following classes together with all of their attributes, events and internal behaviours:

- InterchangedProgram
- OctetStringVariable, IntegerVariable, BooleanVariable, ContentRefVariable, ObjectRefVariable

Any conforming MHEG-6 engine shall support the interpretation of any conforming MHEG-6 object whose class belongs to the application domain definition. Especially, a conforming MHEG-6 engine shall meet all of the following criteria:

- it shall conform to ISO/IEC 13522-5;
- it shall support the semantic provisions regarding MHEG-5 InterchangedProgram objects defined in Clause 7;
- if the Applet class is included in the application domain definition, then a conforming MHEG-6 engine shall support interpretation of MHEG-6 Applet objects, together with all of their attributes, events, internal behaviours and elementary actions, as defined in Clause 8;
- it shall support execution of JVM code as defined in Clause 9;
- it shall provide JVM code with full access to the kernel API defined in Clause 10;
- it shall provide JVM code with access to the MHEG-5 API defined in Clause 11 and Annex C, in either its reduced grade or its complete grade;
- it shall support the MHEG-5/JVM interworking provisions defined in Clause 12.

5.2.2 Conformance documentation

A conformance document with the following information shall be available for an implementation claiming conformance to this part of ISO/IEC 13522. The conformance document shall meet all of the following criteria:

- it shall list all the mandatory features required by this part of ISO/IEC 13522 or in ISO/IEC 13522-5, with reference to the appropriate Clauses and subclauses;
- it shall contain a statement that indicates the full names, numbers, and dates of the standards that apply;
- it shall state which of the optional features defined in this part of ISO/IEC 13522 or in ISO/IEC 13522-5 are supported by the implementation; for this purpose, it shall document all the application domain-dependent features as specified in Clause 4 of ISO/IEC 13522-5;
- it shall describe the behaviour of the implementation for all implementation-dependent features defined in this part of ISO/IEC 13522 or in ISO/IEC 13522-5. This requirement shall be met by listing these features and by providing either a specific reference to the system documentation or full syntax and semantics of these features. The conformance document may specify the behaviour of the implementation for those features where this part of ISO/IEC 13522 or ISO/IEC 13522-5 states that implementations may vary or where features are identified as undefined or unspecified.

5.3 Application conformance

Any InterchangedProgram object interchanged within a conforming MHEG-6 application (see 3.16) shall be a conforming MHEG-6 InterchangedProgram object. In addition, all objects of a conforming MHEG-6 application shall be encoded according to the same notation, either that defined by Annex A or that defined by Annex B.

6 Structure of this part of ISO/IEC 13522

The MHEG-6 specification consists of the following elements:

- a) MHEG-5 objects as interchange units:
 - 1) complying with the structure and semantics defined by ISO/IEC 13522-5;
 - 2) specialised by syntax restrictions and semantic extensions on the InterchangedProgram class (see Clause 7);
 - 3) extended by the new Applet class and the new Invoke action (see Clause 8);
 - 4) with the coded representation defined by Annex A, that extends Annex A of ISO/IEC 13522-5 in a fully compatible way;
 - 5) or with the coded representation defined by Annex B, that extends Annex B of ISO/IEC 13522-5 in a fully compatible way;
- b) JVM code as the interchange format of the OriginalContent attribute of InterchangedProgram objects:
 - 1) complying with the JVM coded representation and semantics (see Clause 9);
 - 2) together with a kernel API (the java.lang, java.util and java.io packages) that provides JVM code with the required resident functionality (see Clause 10);
 - 3) augmented by an MHEG-5 API (the iso.mheg5 package) that provides JVM code with access to MHEG-5 objects and control of MHEG-5 behaviour (see Clause 11 and Annex C);
 - 4) completed by a set of provisions that express the interworking execution semantics, both regarding invocation of JVM methods from MHEG-5 objects and invocation of MHEG-5 elementary actions from JVM classes (see Clause 12).

7 MHEG-6 InterchangedProgram class

This Clause lists the semantic extensions and syntax restrictions applicable to the InterchangedProgram class and its subclasses, as well as the elementary actions that affect them.

Unless otherwise specified in this subclause, any MHEG-6 object shall follow the MHEG-5 class syntax specified by ISO/IEC 13522-5.

This subclause specifies the restrictions on the syntax of MHEG-5 classes, i.e. the values, options or combinations with which MHEG-6 objects shall comply.

7.1.1 Syntax of InterchangedProgram class

Any MHEG-6 InterchangedProgram object is used to encapsulate one or several JVM classes, whose data are either included in the object or referenced by it.

7.1.1.1 Name attribute

The Name attribute of any MHEG-6 InterchangedProgram object shall be encoded as a sequence of null-terminated UTF-8 encoded strings. Each string shall represent the name of a JVM class encapsulated by the InterchangedProgram object.

NOTE The UTF-8 format for string encoding is defined by the JVM class file format referenced in 9.2. It features variable-length encoding of ISO/IEC 10646 (UCS) characters, so that all non-null ASCII characters are encoded using only one byte.

7.1.1.2 OriginalContent attribute

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The OriginalContent attribute of any MHEG-6 InterchangedProgram object shall be encoded as follows:

- a) if the OriginalContent attribute is of the IncludedContent type, its OctetString value shall follow the syntax defined by the Program content interchange format defined in 12.1.
- b) if the OriginalContent attribute is of the ReferencedContent type, its ContentReference component shall consist of either of the following:
 - 1) a sequence of null-terminated ASCII encoded strings: each string shall represent the name of the file in which the data of the JVM class is stored. This sequence shall consist of the same number of strings as the Name attribute, and its file names shall be listed in the same order as the corresponding class names in the Name attribute; or
 - 2) a null string: in this case, the JVM class names (as expressed by the Name attribute) shall be mapped to local files using platform-dependent mapping rules.

7.1.1.3 ContentHook attribute

The ContentHook attribute of any MHEG-6 InterchangedProgram object shall be set to 0, the reserved value for programs encoded in JVM code.

7.1.1.4 Shared attribute

The Shared attribute of any MHEG-6 InterchangedProgram object that is interchanged as part of an Application object (i.e. has application-wide scope) shall be set to True.

7.1 InterchangedProgram object syntax