INTERNATIONAL STANDARD

ISO/IEC 10744

Second edition
1997-08-01

Information technology — Hypermedia/Time-based Structuring Language (HyTime)

Technologies de l'information — Langage de structuration temporelle/hypermédia (HyTime)

Reference number
ISO/IEC 10744:1997(E)

Contents

ISO/IEC Copyright Office • Case Postale 56 • CH-1211 • Genève 20 • Switzerland

Printed in Switzerland

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.

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 10744 was prepared by Joint Technical Committee JTC1, *Information technology*, Subcommittee SC 18, *Document processing and related communication*.

This second edition cancels and replaces the first edition (ISO/IEC 10744:1992), which has been technically revised.

Annexes A, B, and C form an integral part of this International Standard. Annex D is for information only.

Introduction

The Hypermedia/Time-based Structuring Language (HyTime), defined in this International Standard, provides facilities for representing static and dynamic information that is processed and interchanged by hypertext and multimedia applications. HyTime is an application of ISO 8879, the Standard Generalized Markup Language (SGML).

HyTime supports the classic bibliographic model of information referencing, whereby it is possible to represent links to anything, anywhere, at any time, in a variety of ways. The extension of this model to the computerized information age, known as "integrated open hypermedia" (IOH), is the field of application of HyTime.

HyTime provides standardized mechanisms for specifying interconnections (hyperlinks) within and between documents and other information objects, and for scheduling multimedia information in time and space.

Without HyTime, such information is typically embedded in the processing instructions of hypermedia "scripts" that govern the rendition of such documents, and is therefore not usable for other forms of processing. When HyTime is used, those properties of the information that are independent of specific processing are available for processing by applications and platforms other than the one on which the information was created.

It is for the application designer and user to decide which properties can be isolated from the scripts in this way. In an ideal world, the sole consideration would be whether the properties are intrinsic to the information, regardless of how it is processed. For example, the title of this clause is intrinsic information; the font that it appears in normally is not.

In the real world, representation strategies will vary from one situation to another and will depend on such other considerations as the expected uses of the information, the flexibility of the scripting language, and performance considerations. For this reason, HyTime is highly modularized so that application designers need use only the facilities for the properties they care to describe in a standardized way.

HyTime's rules for the standardized expression of hypermedia structuring are expressed as an "enabling architecture", consisting of a number of "architectural forms" and their associated semantics. The HyTime standard's formal definition as an architecture conforms to the Architectural Form Definition Requirements in annex A of this International Standard.

0.1 HyTime modules

The architectural forms and attributes of the HyTime language are grouped into five modules, each of which have both required and optional facilities. Support for the modules and their options is indicated by "HyTime support declarations."

— Base module

The base module consists of independent utility facilities, some of which are optional. The required facilities support hyperdocument management (using SGML) and identification of object properties. The optional facilities provide lookup tables for commonly used elements, a mechanism for associating use and access policies with objects, and a mechanism for relating attributes and the content of elements to their semantic values by reference. The base module also defines the fundamental coordinate addressing notation used by all the other HyTime modules.

— Location address module

The location address module allows the identification of objects that cannot be addressed by SGML unique identifiers, and objects that are in external documents.

Three basic types of address may be supported: name, semantic location, and coordinate location. Addressing of multiple locations is also possible. The syntax and semantics of these addressing mechanisms are independent of the data content notations of the data being addressed.

NOTE 1 The ability to resolve HyTime addresses in a given notation is dependent on software that can interpret that notation in terms of the abstractions HyTime uses for all addressing (see *6.1.1 Object representation*).

HyTime's system- and notation-independent way of expressing addresses of hypermedia objects also provides the basis of its hyperlinking and scheduling power.

— Hyperlinks module

This module allows relationships ("hyperlinks") to be established among objects, either within a single document or among the constituent documents and information objects of a hyperdocument.

— Scheduling module

This module allows events — occurrences of objects — to be scheduled on the coordinate axes of "finite coordinate spaces" in such a way that their positions can be expressed in terms of their relationships to one another. Measurement along the coordinate axes can be in terms of spatial or temporal units.

— Rendition module

When the scheduling module is used, object modification and/or event projection can be used to represent parameters governing the rendition process.

- Object modification

  The object modification facility allows specification of the order in which objects are to be modified during rendition and of the "object modifiers" (such as amplifiers and filters) that will affect them.

  NOTE 2 The semantics of the modifiers are not defined by HyTime.

- Event projection

  Rendition requires the projection of events into a coordinate space where they can be perceived; for example, from a coordinate space with a virtual time axis to one based on real time. The event projection facility allows specification of the factors for computing the positions and sizes of events in the target coordinate space.

  In situations where the rendered position and size of an event is not predictable (as when user interaction will affect it), the virtual dimensions of the original events may be projected onto real space/time via a formula in some arbitrary user-defined expression language. Such an expression may, among other things, accept late-binding values during rendition to resolve the positions and sizes of projected events.

  NOTE 3 The semantics of formatting the objects to fit the new extents is not defined by HyTime.

Applications can choose to include rendition information as an essential part of a hyperdocument, or it can be incorporated in the "style sheets" of the processing programs. The choice depends on the nature of the information being rendered. In multimedia documents, for example, rendition style tends to be more essential to the document than is the case in conventional documents.

0.2 HyTime applications

HyTime provides a generic level of support for a variety of applications, rather than the semantics for a specific application (that is, HyTime is like a carrier or infrastructure).

The boundary between an application and HyTime is variable, and is determined by the application designer, who is free to decide how much of the information will be expressed in a standardized way using HyTime and how much will be application-specific (for example, in a data content notation).

Because the semantics of HyTime's architectural forms and attributes are standardized, it will be possible to implement supporting software and/or hardware usable for a variety of applications. Applications can define additional attributes when defining an element type that is based on an architectural form. The semantics of the application-defined element types and attributes are the only ones defined by the applications themselves. They could be standardized by an industry group or formally by a national or international standards body.

HyTime attributes have no intrinsic meaning other than that specified in this International Standard. However, an application can impute additional semantics to them, either implicitly, or by defining appropriate element types and attributes. For example, to HyTime, the "dimension reference" architectural form means only that the dimension of one object is calculated from the dimension of another. An application, however, could specify (if it wished) that use of dimension referencing implies a synchronization relationship between the objects, and could emphasize this by using "sync" as the generic identifier of a dimension reference element type.

HyTime elements can occur wherever an application's DTD and the HyTime meta-DTD allow. A finite coordinate space could occur, for example, within a paragraph of a memo in order to represent a calendar or project plan in that context, or several paragraphs could occur as the content of a timed event.

Clients of HyTime, including applications and application architectures, can define non-HyTime architectural forms as well as elements. Although an application may not add architectural forms to HyTime, nor combine HyTime architectural forms with one another, it can create its own architecture (for example, "MyArch") defining its own set of architectural forms. These architectures may be derived wholly or in part from the HyTime architecture. The facilities for defining and using architectures are defined in annex A.3.

If, for example, a document is derived from the HyTime and MyArch architectures, after the content and attributes of each element are processed and validated in SGML terms by the SGML parser, elements with HyTime attributes would be subject to processing and validation by the HyTime engine, while elements with MyArch attributes would be subject to appropriate processing and validation by the application, perhaps aided by a MyArch engine.

HyTime defines some of the parameters needed by an application to accomplish rendition, and some of the rendition functionality. The remainder is provided by the application, or by a document architecture to which the application conforms.

Many different HyTime-conforming applications and architectures could exist, to address different requirements and serve different user constituencies. Such architectures could be incompatible in their non-HyTime aspects, but would still be supportable by a single HyTime engine.

NOTE 4 For example, no application would need to invent its own system for representing finite coordinate spaces, even if its projection functions were extremely intricate and application-specific. HyTime allows application-specific projection functions, using application-chosen (or defined) function languages, to be represented in conjunction with standardized representations of the unprojected and projected finite coordinate spaces.

HyTime's design is optimized for the sequencing and alignment problems encountered in typical hypermedia applications; it is not intended as a

general architectural solution for compound document page layout, for which other solutions are better suited.

NOTE 5 However, HyTime is compatible with a wide variety of such solutions. For example, HyTime finite coordinate spaces could be used to describe the media onto which page description language objects are imaged.

NOTE 6 HyTime shares with the DSSSL standard (ISO/IEC 10179:1996, Document Style Semantics and Specification Language) the fundamental SGML property set and grove abstraction for representing and operating on parsed SGML documents (and other data objects for which groves can be constructed).

0.3 Organization of this International Standard

The structure of this International Standard reflects the modular structure of HyTime, as follows:

— The base module clause (clause 6) is a prerequisite for the other clauses. Some of the facilities it describes are required for all uses of HyTime.

— The location address (clause 7), hyperlinks (clause 8), and scheduling (clause 9) clauses describe modules that are independent of one another.

— The rendition clause (clause 10) describes a module that is dependent on the scheduling module.

— The conformance clause (clause 11) describes requirements that apply to all conforming HyTime documents, applications, and systems.

The text of this International Standard also includes the following annexes:

— annex A

This normative annex defines the SGML Extended Facilities, many of which are prerequisites for the other clauses.

— annex B

This normative annex defines the HyTime property set.

— annex C

This normative annex contains the complete HyTime and General Architecture meta-DTDs as they are used by architectural engines.

— annex D

This informative annex identifies sources of supplementary tutorial and reference materials for HyTime.

Information technology — Hypermedia/Time-based Structuring Language (HyTime)

1 Scope

1.1 Definition of scope

This International Standard defines a language and underlying model for the representation of "hyperdocuments" that link and synchronize static and dynamic (time-based) information contained in multiple conventional and multimedia documents and information objects. The language is known as the "Hypermedia/Time-based Structuring Language", or "HyTime".

HyTime can represent time in both the abstract, or "musical" sense, and in user-defined real-time units. It also provides a way of relating the two so that elements of time-dependent documents can be synchronized.

NOTE 7 This facility extends to the representation of multimedia information the power, once limited to conventional documents, to distinguish intrinsic information content from style considerations.

HyTime's techniques for representing its time model are equally applicable to spatial and other domains; all are treated as systems for measuring along different axes of a coordinate space. Arbitrary cross-references and access paths based on external interactions ("hypermedia links") are also supported.

HyTime's time representation contains sufficient information to derive the durations of both control ("gestural") data (e.g., control information for audio or video hardware) and visual data (e.g., a music score, presentation storyboard, or television script).

The media formats and data notations of objects in a HyTime hyperdocument can include formatted and unformatted documents, audio and video segments, still images, and object-oriented graphics, among others. Users can specify the positions and sizes of occurrences of objects in space and time, using a variety of measurement units and granularities. Temporal requirements of applications ranging from animation to project management can be supported by choosing appropriate measurement granules.

NOTE 8 This International Standard does not address the representation of audio or video content data, but simply defines the means by which the start-time and duration of such data can be synchronized with other digitized information. Nor does it specify the layout process by which occurrences of unformatted documents and other information objects can be made to fit the positions and sizes specified for them.

HyTime is an enabling standard, not an encompassing one. As a result, the objects comprising a HyTime hyperdocument are free to conform to any application architectures, or to document architectures imposed by standards, and to be represented in any notation permitted by those architectures. Only the "hub document", which may determine the hyperdocument membership, must conform to HyTime in addition to any other architectures to which it may conform.

HyTime is designed for flexibility and extensibility. Optional subsets can be implemented, alone or in conjunction with user-defined extensions.

The Hypermedia/Time-based Structuring Language (HyTime) is an SGML application conforming to International Standard ISO 8879 — Standard Generalized Markup Language.

The hyperdocument interchange format recommended in this International Standard is ISO 9069, the SGML Document Interchange Format (SDIF). SDIF is defined in Abstract Syntax Notation 1 (ISO/IEC 8824) and can be encoded according to the basic encoding rules of ISO/IEC 8825 for interchange using protocols conforming to the Open Systems Interconnection (OSI) model. Other interchange formats can also be used.

1.2 Field of application

The field of application of HyTime is "integrated open hypermedia" (IOH), the "bibliographic model" of hyperlinking wherein an author can, by a suitable reference, link to anything, anywhere, at any time.

Because of HyTime's modular design and flexible conformance rules, implementations need support only those facilities that are within their present capabilities. User investment in hyperdocument preparation is nevertheless encouraged because of the well-defined upward-compatible path to a full hypermedia solution.

HyTime is intended for use as the infrastructure of platform-independent information interchange for hypermedia and synchronized and non-synchronized multimedia applications. Application developers will use HyTime constructs to design their information structures and objects, and the HyTime language to represent them for interchange.

NOTE 9 The HyTime language is not intended for encoding the internal representation of information on which application programs act while executing.

Applications can use HyTime to represent hyperdocuments containing information that is at any stage of rendition, from "revisable" to "optimized for interactive access". An application can also choose to convert a rendition of a HyTime hyperdocument into an optimized form for transmission or interactive presentation.

NOTE 10 Whether the HyTime representation of a hyperdocument can be used in a local file system for direct access by programs will depend on the type of information in the hyperdocument, the speed of the platform, and the functions performed by the applications that access the hyperdocument.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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.

ISO 31-0:1992, *Quantities and units — Part 0: General principles*.

ISO 3166:1993, *Codes for the representation of names of countries*.

ISO 8879:1986, *Information processing — Text and office systems — Standard Generalized Markup Language (SGML)*.

ISO 9069:1988, *Information processing — SGML support facilities — SGML Document Interchange Format (SDIF)*.

ISO/IEC 9070:1991, *Information technology — SGML support facilities — Registration procedures for public text owner identifiers*.

ISO/IEC 10179:1996 *Information technology — Processing languages — Document Style Semantics and Specification Language (DSSSL).*

ISO/IEC 13673:[1)], *Information technology — Text and Office Systems — Conformance Testing for Standard Generalized Markup Language (SGML) Systems.*

1) To be published.