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Information technology — Computer graphics and image processing — The Virtual Reality Modeling Language —

Part 1:
Functional specification and UTF-8 encoding

Technologies de l'information — Infographie et traitement de l'image — Le langage de modélisation de réalité virtuelle —

Partie 1: Spécification fonctionnelle et codage UTF-8

Reference number
ISO/IEC 14772-1:1997(E)

Foreword

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ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form a 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. See http://www.iso.ch for information on ISO and http://www.iec.ch for information on IEC.

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. See http://www.iso.ch/meme/JTC1.html for information on JTC 1.

International Standard ISO/IEC 14772 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee 24, *Computer graphics and image processing*, in collaboration with The VRML Consortium, Inc. (http://www.vrml.org) and the VRML moderated email list (www-vrml@vrml.org).

ISO/IEC 14772 consists of the following part, under the general title *Information technology -- Computer graphics and image processing -- The Virtual Reality Modeling Language:*

Part 1: Functional specification and UTF-8 encoding.

Further parts will follow.

Annexes A to C form an integral part of this part of ISO/IEC 14772. Annexes D to F are for information only.

This part of ISO/IEC 14472 is distributed as both a hard copy edition and an HTML file which is on the attached CD-ROM. The paper and the electronic versions contain the same material. However, the structure and presentation are more relevant to the document as viewed on-screen. Please note that the electronic file must be viewed using a recent version of a web browser.

Introduction

Purpose

The Virtual Reality Modeling Language (VRML) is a file format for describing interactive 3D objects and worlds. VRML is designed to be used on the Internet, intranets, and local client systems. VRML is also intended to be a universal interchange format for integrated 3D graphics and multimedia. VRML may be used in a variety of application areas such as engineering and scientific visualization, multimedia presentations, entertainment and educational titles, web pages, and shared virtual worlds.

Design Criteria

VRML has been designed to fulfill the following requirements:

Authorability

Enable the development of computer programs capable of creating, editing, and maintaining VRML files, as well as automatic translation programs for converting other commonly used 3D file formats into VRML files.

Composability

Provide the ability to use and combine dynamic 3D objects within a VRML world and thus allow re-usability.

Extensibility

Provide the ability to add new object types not explicitly defined in VRML.

Be capable of implementation

Capable of implementation on a wide range of systems.

Performance

Emphasize scalable, interactive performance on a wide variety of computing platforms.

Scalability

Enable arbitrarily large dynamic 3D worlds.

Characteristics of VRML

VRML is capable of representing static and animated dynamic 3D and multimedia objects with hyperlinks to other media such as text, sounds, movies, and images. VRML browsers, as well as authoring tools for the creation of VRML files, are widely available for many different platforms.

VRML supports an extensibility model that allows new dynamic 3D objects to be defined

allowing application communities to develop interoperable extensions to the base standard. There are mappings between VRML objects and commonly used 3D application programmer interface (API) features.

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1 Scope

ISO/IEC 14772, the Virtual Reality Modeling Language (VRML), defines a file format that integrates 3D graphics and multimedia. Conceptually, each VRML file is a 3D time-based space that contains graphic and aural objects that can be dynamically modified through a variety of mechanisms. This part of ISO/IEC 14772 defines a primary set of objects and mechanisms that encourage composition, encapsulation, and extension.

The semantics of VRML describe an abstract functional behaviour of time-based, interactive 3D, multimedia information. ISO/IEC 14772 does not define physical devices or any other implementation-dependent concepts (e.g., screen resolution and input devices). ISO/IEC 14772 is intended for a wide variety of devices and applications, and provides wide latitude in interpretation and implementation of the functionality. For example, ISO/IEC 14772 does not assume the existence of a mouse or 2D display device.

Each VRML file:

a. implicitly establishes a world coordinate space for all objects defined in the file, as well as all objects included by the file;

b. explicitly defines and composes a set of 3D and multimedia objects;

c. can specify hyperlinks to other files and applications;

d. can define object behaviours.

An important characteristic of VRML files is the ability to compose files together through inclusion and to relate files together through hyperlinking. For example, consider the file *earth.wrl* which specifies a world that contains a sphere representing the earth. This file may also contain references to a variety of other VRML files representing cities on the earth (e.g., file *paris.wrl)*. The enclosing file, *earth.wrl*, defines the coordinate system that all the cities reside in. Each city file defines the world coordinate system that the city resides in but that becomes a local coordinate system when contained by the earth file.

Hierarchical file inclusion enables the creation of arbitrarily large, dynamic worlds. Therefore, VRML ensures that each file is completely described by the objects contained within it.

Another essential characteristic of VRML is that it is intended to be used in a distributed environment such as the World Wide Web. There are various objects and mechanisms built into the language that support multiple

distributed files, including:

e. in-lining of other VRML files;

f. hyperlinking to other files;

g. using established Internet and ISO standards for other file formats;

h. defining a compact syntax.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 14772. 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 14772 are encouraged to investigate the possibility of applying the most recent editions of the normative documents 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.

Annex E, Bibliography, contains a list of informative documents and technology.

Identifier	Reference
1766	IETF RFC 1766, Tags for the Identification of Languages, Internet standards track protocol. http://ds.internic.net/rfc/rfc1766.txt
CGM	ISO/IEC 8632:1992 (all parts) Information technology -- Computer graphics -- Metafile for the storage and transfer of picture description information. http://www.iso.ch/isob/switch-engine-cate.pl?searchtype=refnumber&KEYWORDS=8632
ESCR	ISO/IEC DIS 16262 Information technology -- ECMAScript: A general purpose, cross-platform programming language. http://www.ecma.ch http://www.iso.ch/isob/switch-engine-cate.pl?searchtype=refnumber&KEYWORDS=16262
HTML	HTML 3.2 Reference Specification. http://www.w3.org/TR/REC-html32.html
I639	ISO 639:1988 Code for the representation of names of languages. http://www.iso.ch/isob/switch-engine-cate.pl?KEYWORDS=10918&searchtype=refnumber, http://www.chemie.fu-berlin.de/diverse/doc/ISO_639.html
I3166	ISO 3166:1997 (all parts) Codes for the representation of names of countries and their subdivisions. http://www.iso.ch/isob/switch-engine-cate.pl?searchtype=refnumber&KEYWORDS=3166
I8859	ISO/IEC 8859-1:1987 Information technology -- 8-bit single-byte coded graphic character sets -- Part 1: Latin alphabet No. 1. http://www.iso.ch/isob/switch-engine-cate.pl?searchtype=refnumber&KEYWORDS=8859

ISOC	ISO/IEC 9899:1990 Programming languages -- C. http://www.iso.ch/isob/switch-engine-cate.pl?searchtype=refnumber&KEYWORDS=9899
ISOG	ISO/IEC 10641:1993 Information technology -- Computer graphics and image processing -- Conformance testing of implementations of graphics standards. http://www.iso.ch/isob/switch-engine-cate.pl?KEYWORDS=10641&searchtype=refnumber
JAVA	"The Java Language Specification" by James Gosling, Bill Joy and Guy Steele, Addison Wesley, Reading Massachusetts, 1996, ISBN 0-201-63451-1. http://java.sun.com/docs/books/jls/index.html "The Java Virtual Machine Specification" by Tim Lindhold and Frank Yellin, Addison Wesley, Reading Massachusetts, 1996, ISBN 0-201-63452-X. http://java.sun.com/docs/books/vmspec/index.html
JPEG	"JPEG File Interchange Format," JFIF, Version 1.02, 1992. http://www.w3.org/pub/WWW/Graphics/JPEG/jfif.txt ISO/IEC 10918-1:1994 Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines. http://www.iso.ch/isob/switch-engine-cate.pl?KEYWORDS=10918&searchtype=refnumber
MIDI	Complete MIDI 1.0 Detailed Specification, MIDI Manufacturers Association, P.O. Box 3173, La Habra, CA 90632 USA 1996. http://www.midi.org
MPEG	ISO/IEC 11172-1:1993 Information technology -- Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s -- Part 1: Systems. http://www.iso.ch/isob/switch-engine-cate.pl?searchtype=refnumber&KEYWORDS=11172
PNG	PNG (Portable Network Graphics), Specification Version 1.0, W3C Recommendation, 1 October 1996. http://www.w3.org/pub/WWW/TR/REC-png-multi.html
RURL	IETF RFC 1808 Relative Uniform Resource Locator, Internet standards track protocol. http://ds.internic.net/rfc/rfc1808.txt
URL	IETF RFC 1738 Uniform Resource Locator, Internet standards track protocol. http://ds.internic.net/rfc/rfc1738.txt

UTF8	ISO/IEC 10646-1:1993 Information technology -- Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane, Internet standards track protocol. http://www.iso.ch/isob/switch-engine-cate.pl?searchtype=refnumber&KEYWORDS=10646, http://ds.internic.net/rfc/rfc2044.txt