INTERNATIONAL STANDARD

ISO/IEC 9636-1

Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification —

Part 1:
Overview, profiles, and conformance

Technologies de l'information — Infographie — Interfaces pour l'infographie — Spécifications fonctionnelles —

Partie 1: Résumé, profils et conformité

Contents

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 9636-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

ISO/IEC 9636 consists of the following parts, under the general title *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification*:

— *Part 1: Overview, profiles, and conformance*
— *Part 2: Control*
— *Part 3: Output*
— *Part 4: Segments*
— *Part 5: Input and echoing*
— *Part 6: Raster*

Annexes A and B form an integral part of this part of ISO/IEC 9636. Annexes C, D, E and F are for information only.

Introduction

Purpose

The Computer Graphics Interface (CGI) specifies a standard interface between device-independent and device-dependent parts of a graphics system. ISO/IEC 9636 specifies sets of functions for control and data exchange over this interface. This interface may be implemented as a software-to-software interface (as a data stream encoding used in a network environment or as a procedural binding to one or more software packages), or as a software-to-hardware interface (as a data stream encoding to one or more devices presenting a standardized Computer Graphics Interface as their device protocol). Related standards specify data stream encodings (for use in the software-to-software case, over a network, and in the software-to-hardware case), and procedural bindings (for use in the software to software case).

ISO/IEC 9636 includes a reference model and a description of the CGI's relationship to other standards.

ISO/IEC 9636 only defines graphics functions, graphics control functions, and functions to control data representations and deferral in data stream encodings. ISO/IEC 9636 does not define the protocols to be used to convey these functions between the parts of a (potentially distributed) system.

Benefits

Intrinsic   The CGI will simplify the development and implementation of graphics systems. ISO/IEC 9636 will encourage a uniform access to the graphics devices within an installation. As new devices are made available, graphics device drivers adhering to this interface can be installed for use by existing programs.

Interchange   ISO/IEC 9636 promotes the exchange of software between installations. By isolating the device-dependent aspects of any graphics system, modularity is encouraged, which promotes increased portability. The standard set of functions, access mechanisms, and terminology will allow developers and users to move between installations with minimal retraining.

Educational   The standard set of functions uses a standard terminology. This allows both the academic and industrial communities to develop instructional programs concentrating on programming techniques and methodologies based on these standard functions.

Economic   In view of the trend towards lower hardware and higher software costs, the following benefits accrue from ISO/IEC 9636:

- It encourages transporting of software between installations, thereby reducing costs associated with "reinvention";

- It protects the large software investment made by both users and vendors because the software will not be rendered obsolete by the introduction of new devices;

- It allows developers of new software to focus on higher-level graphics functions and applications instead of device-level functions;

- It reduces maintenance of software systems because the standard encourages modularity;

- It increases vendor independence for the user because any system designed to use a particular device can more easily be changed to use some other device;

- It allows vendors to develop and market devices that will easily interface to the customer's system;

- It enables users, manufacturers and vendors to take advantage of new, lower-cost graphics hardware designs. The total system's hardware cost may be reduced because system redesign may not be necessary.

Design requirements

To realize the benefits described above, a number of design principles have been adopted:

a) The Computer Graphics Interface should provide a suitable set of functions for the description of a wide range of pictorial information;

b) The Computer Graphics Interface should provide a suitable set of functions for the necessary CGI session control of a wide range of graphics devices;

c) The Computer Graphics Interface should address the more usual and essential features found on graphical devices directly and should provide access to less common facilities;

d) The design of the Computer Graphics Interface should not preclude extension of ISO/IEC 9636 at a later stage to cover facilities currently not standardized;

e) The Computer Graphics Interface should be usable from GKS (Graphical Kernel System - ISO 7942). In particular, the CGI should include functional capability to support the various levels of a GKS workstation in an efficient and concise manner, without compromising the ability of the interface to support non-GKS systems in an efficient and concise manner;

f) The Computer Graphics Interface should be compatible with the Computer Graphics Metafile - ISO 8632. In particular, those CGM elements not associated with the file-oriented aspects of the CGM shall have corresponding CGI functions which have identical abstract names and parameterization;

g) ISO/IEC 9636 should address the needs of different applications that have conflicting requirements for

 – allocation of processing burden between host and device;

 – speed of generation and interpretation of functions;

 – ease of transfer through different transport mechanisms.

Design criteria

The above requirements were used to formulate the following design criteria:

a) Completeness
In any area of ISO/IEC 9636, the functionality specified by ISO/IEC 9636 should be complete in itself.

b) Conciseness
Redundant functions or parameters should be avoided.

c) Consistency
Contradictory functions should be avoided.

d) Extensibility
The ability to add new functions and generality to ISO/IEC 9636 should not be precluded.

e) Fidelity
The results and behaviour of functions should be well defined.

f) Implementability
A function should be able to be efficiently supported on most host systems andor graphics hardware.

g) Orthogonality
Independent functions for separate and noninteracting activities should be provided.

h) Predictability
The recommended or proper use of a standard function should guarantee the results of using that particular function.

i) Standard practice
Only those functions that reflect existing practice, that are necessary to support existing practice, or that are necessary to support standards being developed concurrently should be standardized.

j) Usefulness

Functions should be powerful enough to perform useful tasks.

k) Well-structured

The number of assumptions that functions make about each other should be minimized. A function should have a well-defined interface and a simply stated unconditional purpose. Multi-purpose functions and side effects should be avoided.

Parts of the CGI functional specification

ISO/IEC 9636, the functional specification of the Computer Graphics Interface, consists of a number of parts presenting portions of the CGI functionality, including an overview in this part of ISO/IEC 9636.

Table 1 – Parts of the CGI Functional Specification

Part No.	Title
ISO/IEC 9636-1	Overview, profiles, and conformance
ISO/IEC 9636-2	Control
ISO/IEC 9636-3	Output
ISO/IEC 9636-4	Segments
ISO/IEC 9636-5	Input and echoing
ISO/IEC 9636-6	Raster

This part of ISO/IEC 9636 gives a general overview and introduction to the basic concepts and principles of ISO/IEC 9636. It includes a reference model, the relationship to other standards, and profiles. In addition, it contains overviews of each of the subsequent parts. This part of ISO/IEC 9636 thus establishes the framework for all the parts of ISO/IEC 9636; it does not contain functional descriptions.

The functional capability provided by the CGI is separate from the specification of any particular encoding format or language binding.

Information technology – Computer graphics – Interfacing techniques for dialogues with graphical devices (CGI) – Functional specification –

Part 1:
Overview, profiles, and conformance

1   Scope

ISO/IEC 9636 establishes the conceptual model, functional capability, and minimum conformance requirements of the Computer Graphics Interface (CGI). It specifies design requirements for encodings of the CGI. ISO/IEC 9636 defines a set of CGI functions that is expected to satisfy the following needs of a majority of the computer graphics community:

   a)   provide an interface standard for computer graphics software package implementors;

   b)   provide an interface standard for computer graphics device manufacturers and suppliers;

   c)   provide an inquiry and response mechanism for graphics device capabilities, characteristics, and states;

   d)   provide a standard graphics escape mechanism to access non-standard graphics device capabilities;

   e)   allow for future functional extension of the CGI.

In addition to the CGI functionality, device classes, and Foundation and Constituency Profiles are defined. The device classes included in the CGI are output (OUTPUT), input (INPUT), and output/input (OUTIN). Profiles allow subsets of the CGI functions and features to be defined to suit particular well identified groups of users. There is also provision for Constituency Profiles to be registered after ISO/IEC 9636 is published. The Computer Graphics Interface (CGI) is a standard functional and syntactical specification of the control and data exchange between device-independent graphics software and an implementation of a CGI Virtual Device.

The syntax of the CGI, presented in ISO/IEC 9636, is an encoding-independent and binding-independent specification. Any similarity of the examples or function specifications to a particular encoding technique or language is coincidental unless explicitly stated otherwise.

The functions specified provide for the representation of a wide range of two-dimensional pictures and for control over their display on a wide range of graphics devices. The functions are split into groups that perform device and CGI session control, specify the data representations used, control the display of the picture, perform basic drawing actions, control the attributes of the basic drawing actions, acquire data from input devices, and provide access to non-standard device capabilities.

This part of ISO/IEC 9636 gives an overview of ISO/IEC 9636, explains the relationship between its parts and their relation to other standards, describes a reference model for graphics systems, and defines certain Foundation and Constituency Profiles. ISO/IEC 9636-2, ISO/IEC 9636-3, ISO/IEC 9636-4, ISO/IEC 9636-5, and ISO/IEC 9636-6 specify the CGI functions for different functional areas using an abstract notation.

ISO/IEC 9637 and ISO/IEC 9638 define standard data stream encodings, procedural library bindings, and single entry point procedural bindings of the CGI.

1.1   Relationship of CGI to a computing environment

ISO/IEC 9636 describes graphical services provided by a Virtual Graphics Device. The model for description of these services is expressed in terms of graphical capabilities of a single instance of a hypothetical graphics device. In all but the simplest of

computing environments, CGI functions alone will not be sufficient to provide complete control over a device. Additional functions, not included in ISO/IEC 9636, will likely be needed. Examples of such functions include

- means to configure (sets of) physical devices to be accessed as CGI Virtual Devices;

- means to control a device capable of offering CGI-defined services as well as other, non-CGI-defined services, such as those implied by ISO 2022 and ISO 6429;

- means to differentiate among separate instances of CGI Virtual Devices in the same computing environment;

- means of defining or determining communication paths from CGI clients to CGI Virtual Devices.

In some cases, other standards exist that describe the functions required. For example, various communications standards address the needs of the last point above. In other cases, no standards may exist, but the tasks indicated are outside the scope of ISO/IEC 9636.

1.2   Position of CGI in a managed environment

There exists a large and growing family of computer controlled display systems that have the ability to act as if they are multiple individual display devices. Resources, most notably the visible drawing surface resources, are coordinated by the display system so that multiple non-cooperating client programs can each access the services of a separate individual device while all are actually running in a single managed environment.

The graphical capabilities of the CGI Virtual Device may suffice, in some instances, as the basis for implementing a complex, multiple-client display system. However, the complete needs of such a system are quite complex, include many non-graphical services, and (as current practice shows) are quite technology dependent. The CGI does not, therefore, purport to be a generally sufficient interface on which a managed display environment may be built. Rather, within a managed environment, the CGI will be one of the managed interfaces in a way not visible to the CGI client without recourse to services not part of ISO/IEC 9636. The use of the CGI as a managed interface within a managed display environment is not limited to raster devices.

2   Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9636. 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 9636 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 646 : 1983   *Information processing – ISO 7-bit coded character set for information interchange.*

ISO 2022 : 1986   *Information processing – ISO 7-bit and 8-bit coded character sets – Code extension techniques.*

ISO 2382-13 : 1984 *Data processing – Vocabulary – Part 13: Computer graphics.*

ISO 6429 : 1988   *Information processing – Control functions for 7-bit and 8-bit coded character sets.*

ISO 7942 : 1985   *Information processing systems – Computer graphics – Graphical Kernel System (GKS) functional description.*

ISO 7498 : 1984   *Information processing systems – Open systems interconnection – Basic reference model.*

ISO 8632-1 : 1987   *Information processing systems – Computer graphics – Metafile for the storage and transfer of picture description information – Part 1: Functional specification.*

ISO 8632-2 : 1987   *Information processing systems – Computer graphics – Metafile for the storage and transfer of picture description information – Part 2: Character encoding.*

ISO 8632-3 : 1987   *Information processing systems – Computer graphics – Metafile for the storage and transfer of picture description information – Part 3: Binary encoding.*

ISO 8805 : 1988   *Information processing systems – Computer graphics – Graphical Kernel System for Three Dimensions (GKS-3D) functional description.*

ISO 9282-1 : 1988 *Information processing – Coded representation of pictures – Part 1: Encoding principles for picture representation in a 7-bit or 8-bit environment.*

ISO/IEC 9592-1 1989 *Information processing systems – Computer graphics – Programmer's Hierarchical Interactive Graphics System (PHIGS) – Part 1: Functional description.*

ISO/IEC 9636-2 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 2: Control.*

ISO/IEC 9636-3 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 3: Output.*

ISO/IEC 9636-4 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 4: Segments.*

ISO/IEC 9636-5 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 5: Input and echoing.*

ISO/IEC 9636-6 : 1991 *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Functional specification — Part 6: Raster.*

ISO/IEC 9637-1 : -[1] *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Data stream binding — Part 1: Character encoding.*

ISO/IEC 9637-2 : -[1] *Information technology — Computer graphics — Interfacing techniques for dialogues with graphical devices (CGI) — Data stream binding — Part 2: Binary encoding.*

ISO/IEC TR 9973 : 1988 *Information processing — Procedures for registration of graphical items.*

ANSI/IEEE 754 –   *Standard for Binary Floating Point Arithmetic.*

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[1]   To be published.