INTERNATIONAL STANDARD

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Information technology — Open Document Architecture (ODA) and Interchange Format: Raster graphics content architectures

Technologies de l'information — Architecture des documents ouverts (ODA) et format d'échange: Architecture des contenus des caractères graphiques à raster

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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 8613-7 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 18, *Document processing and related communication*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation T 417.

This second edition cancels and replaces the first edition (ISO 8613-7:1989), which has been technically revised.

ISO/IEC 8613 consists of the following parts, under the general title *Information technology — Open Document Architecture (ODA) and interchange format*:

- *Part 1: Introduction and general principles*
- *Part 2: Document structures*
- *Part 3: Abstract interface for the manipulation of ODA documents*
- *Part 4: Document profile*
- *Part 5: Open document interchange format*
- *Part 6: Character content architectures*
- *Part 7: Raster graphics content architectures*
- *Part 8: Geometric graphics content architectures*
- *Part 9: Audio content architectures*
- *Part 10: Formal specifications*
- *Part 11: Tabular structures and tabular layout*
- *Part 12: Identification of document fragments*
- *Part 13: Spreadsheet*
- *Part 14: Temporal relationships and non-linear structures*

INTRODUCTION

This ITU-T Recommendation | International Standard was prepared as a joint publication by ITU-T Study Group 8 and ISO/IEC Joint Technical Committee 1.

At present, the ITU-T Recommendation T.410-Series | ISO/IEC 8613 consists of:

- Introduction and general principles;
- Document structures;
- Document profile;
- Open document interchange formats;
- Character content architectures;
- Raster graphics content architectures;
- Geometric graphics content architectures;
- Formal Specification of the Open Document Architecture (FODA).

NOTE – The use of FODA is applicable to ISO/IEC only.

Further Specifications may be added to this set of ITU-T Recommendations | International Standard.

Development of these Recommendations | International Standard was originally in parallel with ECMA 101:1989, Open Document Architecture.

This set of ITU-T Recommendations | International Standard replaces the CCITT T.410-Series of Recommendations (1988) and ISO 8613:1989.

Significant technical changes are the inclusion in this Recommendation | International Standard of the following amendments as agreed by ITU-TS and ISO/IEC JTC 1:

- Tiled raster graphics;
- Colour.

In addition, a number of technical corrigenda have been applied to the Specification.

This part contains three annexes:

- Annex A (integral) contains a summary of the raster graphics content architecture classes;
- Annex B (non-integral) lists the ASN.1 object identifiers used by the raster graphics content architecture;
- Annex C (integral to ISO/IEC only) contains ODL, the SGML representation of the attributes specific to raster graphics content architectures.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN DOCUMENT ARCHITECTURE (ODA) AND INTERCHANGE FORMAT: RASTER GRAPHICS CONTENT ARCHITECTURES

1 Scope

The purpose of the ITU-T Rec. T.410-Series | ISO/IEC 8613 is to facilitate the interchange of documents.

In the context of these Recommendations | International Standards, documents are considered to be items such as memoranda, letters, invoices, forms and reports, which may include pictures and tabular material. The content elements used within the documents may include graphic characters, geometric graphics elements and raster graphics elements, all potentially within one document.

NOTE – These Recommendations | International Standards are designed to allow for extensions, including hypermedia features, spreadsheets and additional types of content such as audio and video.

In addition to the content types defined in these specifications, ODA also provides for arbitrary content types to be included in documents.

These Recommendations | International Standards apply to the interchange of documents by means of data communications or the exchange of storage media.

These Recommendations | International Standards provide for the interchange of documents for either or both of the following purposes:

- to allow presentation as intended by the originator;
- to allow processing such as editing and reformatting.

The composition of a document in interchange can take several forms:

- formatted form, allowing presentation of the document;
- processable form, allowing processing of the document;
- formatted processable form, allowing both presentation and processing.

These Recommendations | International Standards also provide for the interchange of ODA information structures used for the processing of interchanged documents.

This ITU-T Recommendation | International Standard defines:

- the raster graphics content architectures that can be used in conjunction with the document architecture defined in ITU-T Rec. T.412 | ISO/IEC 8613-2;
- the internal structure of content portions that are structured according to a raster graphics content architecture;
- those aspects of positioning and imaging applicable to the presentation of raster graphics contents in a basic layout object;
- a content layout process which, together with the document layout process defined in ITU-T Rec. T.412 | ISO/IEC 8613-2, specifies the method for determining the dimensions of basic layout objects for raster graphics content portions;
- the presentation and content portion attributes applicable to raster graphics content architectures.

2 Normative references

The following ITU-T Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The ITU-T Secretariat maintains a list of currently valid ITU-T Recommendations/CCITT Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation T.411 (1992) | ISO/IEC 8613-1:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Introduction and general principles.*
- ITU-T Recommendation T.412 (1992) | ISO/IEC 8613-2:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Document structures.*
- ITU-T Recommendation T.414 (1992) | ISO/IEC 8613-4:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Document profile.*
- ITU-T Recommendation T.415 (1992) | ISO/IEC 8613-5:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Open Document Interchange Format.*

2.2 Paired Recommendations | International Standards equivalent in technical content

- CCITT Rec. X.208 (1988), *Specification of abstract syntax notation one (ASN.1).*

  ISO/IEC 8824:1990, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1).*
- CCITT Rec. X.209 (1988), *Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1).*

  ISO/IEC 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).*

2.3 Additional references

- ITU-T Recommendation T.4 (1993), *Standardization of Group 3 facsimile apparatus for document transmission.*
- CCITT Recommendation T.6 (1992), *Facsimile coding schemes and coding control functions for Group 4 facsimile apparatus.*
- ISO 8879:1986, *Information processing – Text and office systems – Standard Generalized Markup Language (SGML).*

3 Definitions

For the purposes of this Recommendation | International Standard, the definitions given in ITU-T Rec. T.411 | ISO/IEC 8613-1 apply. For the purpose of this Specification the definitions in CCITT Recommendations T.4 and T.6 apply.

4 Abbreviations

For the purposes of this Recommendation | International Standard, the abbreviations in ITU-T Rec. T.411 | ISO 8613-1 apply.

For the purposes of this Recommendation | International Standard, the following additional abbreviations apply.

AAH	Horizontal dimension of available area
AAV	Vertical dimension of available area
BDH	Horizontal block dimension
BDV	Vertical block dimension
EOFB	End-of-facsimile-block
MSB	Most significant bit

NLC	Number of lines of the clipped array
NPC	Number of pels per line of the clipped array
PS	Pel spacing
RTC	Return-to-control
SR	Spacing ratio

5 Conventions

For the purposes of this Recommendation | International Standard, the conventions given in ITU-T Rec. T.411 | ISO 8613-1 apply.

6 General principles

6.1 Content architecture classes

This Specification defines two classes of raster graphics content architectures:

- Formatted raster graphics content architecture class, which allows for document content to be presented as intended by the originator. Formatted form content can only be associated with basic layout components.
- Formatted processable raster graphics content architecture class, which allows for document content to be processed and also to be presented as intended by the originator. Formatted processable content can be associated with any basic component.

6.1.1 Formatted content architecture class

Formatted raster graphics content is intended to be laid out, or imaged, by the recipient in accordance with the originator's intent. It is not intended to be reformatted. This form of content may only be used in formatted form documents.

For this form of content all the necessary information for positioning of pels has been specified. The method of positioning is specified in clause 8.

A particular feature of this form of content is that the position of the pel array can be offset relative to the position of the basic layout object. As a result, it is possible that not all of the area of the basic layout object is utilized for positioning pels. A portion of the pel array may also be positioned such that it is outside the basic layout object. Such a portion, if any, is not imaged.

6.1.2 Formatted processable content architecture class

Formatted processable raster graphics content is intended to be laid out, reformatted or imaged by the recipient in accordance with the originator's intent. This form of content may be used in formatted, processable and formatted processable form documents.

The originator may, when using this form of content, specify the precise requirements for the layout and imaging of the pel array. Alternatively, the originator may specify various constraints concerning the intended layout and imaging of the pel array, i.e. the precise requirements are not specified and the layout is determined by the content layout process performed by the recipient.

When the precise requirements for the layout are specified, the fixed dimension layout method is used to layout and image the content. Otherwise, the content is laid out and imaged using the scalable dimension layout method. These layout methods are defined in clause 12.

A particular feature of these layout methods is that in both cases the content is laid out such that the entire basic layout object is utilized. In addition it is possible to specify that only a portion of the pel array is to be laid out.

6.2 Content

There are two modes, named *binary* and *colour*, for determining the image of a pel. Each encoding scheme defined in clause 11 corresponds to just one mode.

6.2.1 Binary mode

In the binary mode, the data which determines the image of a pel specifies one of the two states, named *set* and *unset*. The set state indicates that the colour specified in the attribute "content foreground colour" applying to the object to which the content is associated is to be used. The unset state indicates that the colour specified in the attribute "content background colour" applying to the object to which the content is associated is to be used. Both attributes are defined in ITU-T Rec. T.412 | ISO/IEC 8613-2.

NOTE – According to ITU-T Rec. T.414 | ISO/IEC 8613-4, all of the colour space types RGB, CMY(K), CIELUV, and CIELAB are permitted.

6.2.2 Colour mode

In the colour mode, the colour of the image of a pel is specified in the pel encoding.

The attribute "content background colour" applying to the object with which the content is associated is ignored. The attribute "content foreground colour" applying to the object with which the content is associated is used in some encoding schemes to derive the reference to the applying colour space and the colour tolerance specification (see clause 11).

NOTE – According to ITU-T Rec. T.414 | ISO/IEC 8613-4, all of the colour space types RGB, CMY(K), CIELUV, and CIELAB are permitted.

6.3 Presentation attributes

Presentation attributes are applicable to basic components and specify information for laying out and imaging the content of the basic component, and are defined in clause 7. This information cannot be modified within the content of the basic component to which it applies.

All raster graphics content presentation attributes are:

- non-mandatory when specified for presentation styles;
- non-mandatory when applied to object class descriptions;
- defaultable when applied to object descriptions.

Presentation attributes are classified as shared attributes, layout attributes or logical attributes:

- shared attributes are applicable to logical and layout components;
- layout attributes are applicable only to layout components;
- logical attributes are applicable only to logical components.

6.4 Content portion attributes

Content portion attributes are applicable to content portions and specify information related to the identification and coding of the content. They are also used in laying out and imaging the content of the content portion. Content portion attributes are defined in clause 9.

6.5 Coding of content information

The methods of encoding the pel array in a content portion structured according to a raster graphics content architecture are specified in clause 11.

6.6 Picture element (pel) array

The picture elements in an array have a defined order. The array consists of an ordered sequence of rows of picture elements. Each row in the array contains the same number of picture elements and consists of an ordered sequence of picture elements that represents a line of the image.

6.7 Colour spaces applicable to the raster graphics content architecture

The raster graphics content architecture can employ colour specification in CIELUV, CIELAB, RGB or CMY(K) (see Figure 1). Colour may be specified in either direct mode or indexed mode.

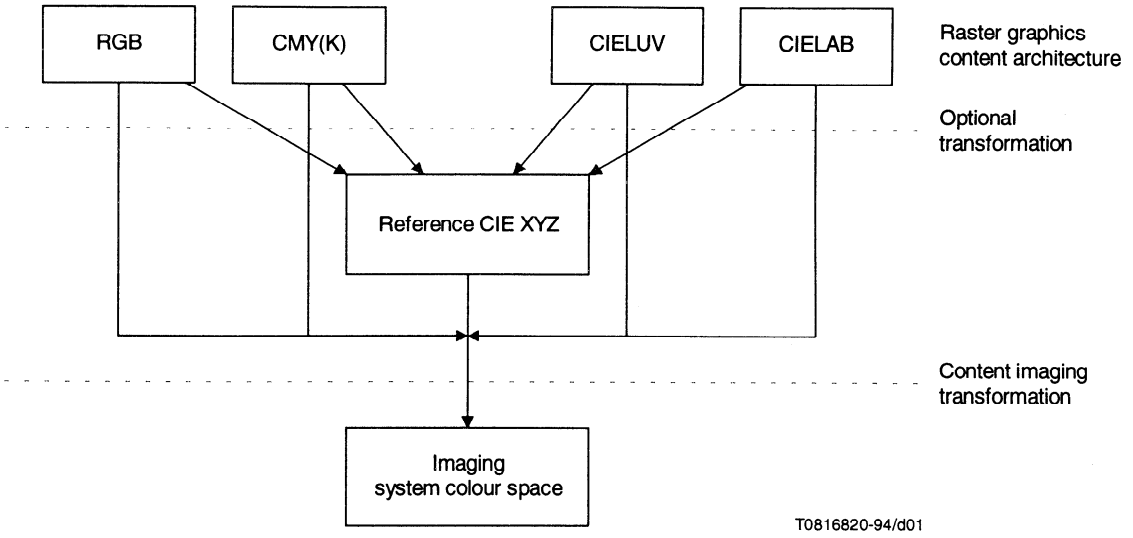


Figure 1 – Relationships among the colour spaces for the raster graphics content architecture

In order to support colour, the data which determine the image of a pel are separated into colour components. Each colour component corresponds to one dimension of the colour space in which the image is specified. For example, for an image specified in CIELUV in direct mode, the data for each pel comprise three colour components representing , and L*, u* and v* values.

NOTE – Additional compression techniques are required for compression of colour images. A basic run-length compression is defined in this version of the ITU-T Rec. T.410-Series | ISO 8613, and it is anticipated that further techniques will be specified in later versions. An example might be the use of sub-sampling of the u^* and v^* components in CIELUV. Such techniques may require parameters specific to them, in which case it will be necessary to introduce an attribute for this purpose.

7 Principles of positioning pels

Two methods of positioning pels within a basic layout object are described in this clause. One of these applies to content portions which pertain to the formatted content architecture class. The other applies to content portions which pertain to the formatted processable form content architecture class.

The general principles of positioning that apply to both these methods are described in 7.5.1. Subsequently, 7.5.2 and 7.5.3 describe the specific principles that apply to the formatted and formatted processable content architecture class.

A basic logical component with a formatted processable content architecture class must undergo the content layout process before it can be positioned and imaged. The content layout process (defined in clause 12) determines the block size into which the content portion is to be imaged. The content is then positioned in accordance with the positioning rules for content pertaining to the formatted processable content architecture class.

Any parts of a raster graphics content portion which extend beyond the boundaries of the basic layout object are not imaged.

7.1 Basic concepts

7.1.1 Measurement units and directions

For raster graphics content, the unit for positioning pels is the Scaled Measurement Unit (SMU).

The SMU is derived from the Basic Measurement Unit BMU by multiplying the BMU with a factor which is specified by the attribute "unit scaling" (defined in ITU-T Rec. T.414 | ISO/IEC 8613-4). The BMU and SMU are defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2.

All directions are expressed as counter clockwise angles of rotation relative to some specified reference direction (as illustrated in Figure 2).

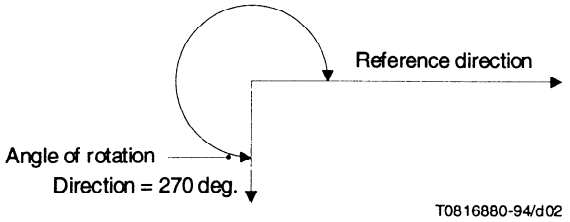


Figure 2 – Example of direction

7.1.2 Coordinate systems

Two rectangular coordinate systems are used in the positioning of pels.

One system is a dimensionless coordinate system used to identify the pels that constitute a clipped pel array (defined in 7.3.1). In this system, the origin of the coordinate system is positioned at the first pel in the pel array. One axis is in the direction of the pels in each row of pels. The second axis is in the direction of the columns of pels. This system uses non-negative dimensionless integer values. Coordinate pairs are denoted using upper case letters.

The second system is used for the positioning of pels associated with basic layout objects. In this system, one axis is parallel to the horizontal axis of the page coordinate system (defined in ITU-T Rec. T.412 | ISO/IEC 8613-2) and the other axis is in a direction d270 relative to the horizontal axis. This system uses rational values in scaled measurements units (SMUs) to identify points or specify lengths within a basic layout object. Coordinate pairs are indicated by lower case letters.

7.2 Pel image model

Each pel is associated with a *reference area*. The side of the reference area along the direction of the pel path equals the pel spacing and the side along the direction of line progression equals the line spacing.

Each reference area has a *reference point*, which is used for positioning the pel. The reference point is defined as the corner of the reference area situated in the direction opposite to both pel path and line progression. The position of a pel in a basic layout object is defined as the position of the reference point of the reference area of that pel.

NOTE – The position of the image of the pel relative to the reference area is implementation dependent, but it is the intention that the main part of the image of the pel is positioned within the reference area.

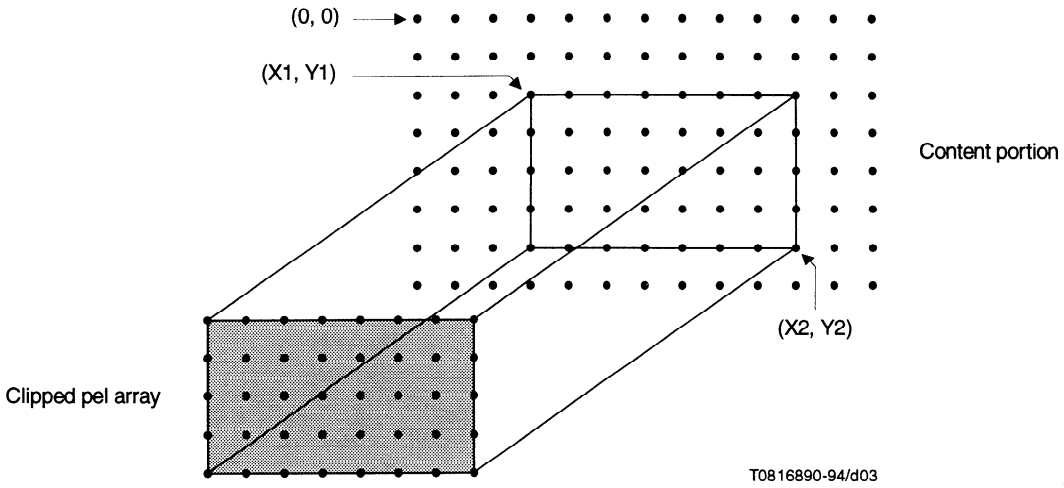
7.3 Positioning of pels

In general, when positioning (and subsequently imaging) the content of a content portion in relation to a basic layout object, only part of the content is considered. Two methods of selecting the required part of the content are provided:

- specification of a clipped pel array;
- discarding of pels.

7.3.1 The clipped pel array

The clipped pel array is a rectangular array of pels defined by two coordinate pairs in the dimensionless coordinate system. The diagonally opposite pairs of the clipped pel array are identified by the coordinate pairs (X1, Y1) and (X2, Y2) where X1 ≤ 2 and Y1 ≤ Y2. Figure 3 illustrates the clipping of a content portion.



(X1, Y1) "Clipping" first coordinate pair
(X2, Y2) "Clipping" second coordinate pair

Figure 3 – Example of clipping a content portion

7.3.2 Discarded pels

In the formatted raster graphics content architecture class, the number of pels to be discarded at the beginning and the end of each line of pels can be specified by a coding attribute.

7.4 Tiling

The pel array may be segmented into a two-dimensional array of non-overlapping rectangular regions called *tiles*. The content information of each tile is coded independently of the coding of the content information of the other tiles of the same pel array.

Tiling facilitates convenient access to, and/or processing of portions of the pel array independent of access to, and/or processing of other portions. The capability to encode each tile separately as bitmap, compressed or null maximizes the possible compression of the tiled pel array.

NOTE 1 – Tiling provides an alternative method for coding of raster graphics content and therefore does not affect the positioning of the clipped pel array.

The basic concepts, pel image model and positioning of pels in a basic layout object continue to apply. Furthermore the attributes for pel array clipping continue to apply to the pel array.

The location of pel array content relative to the tile content is specified by the "tiling offset" attribute. Figure 4 illustrates the location of the pel array in the set of tiles.

Tiled raster graphics content information consists of a sequence of tiles ordered in the direction of the pel path and line progression as illustrated in Figure 5.

The content of each tile may be encoded according to ITU-T Recs. T.4, T.6, T.4 – MSB, T.6 – MSB or bitmap encoded as specified by the coding attributes. Alternatively, it may be omitted if the pels within the tile are either all foreground or all background.

NOTE 2 – Rec. T.6 encoding – MSB and Rec. T.4 encodings – MSB apply to ITU-TS only.