INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

T.417

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(03/93)

TELEMATIC SERVICES

TERMINAL EQUIPMENTS AND PROTOCOLS FOR TELEMATIC SERVICES

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

ITU-T Recommendation T.417

Foreword

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. Some 179 member countries, 84 telecom operating entities, 145 scientific and industrial organizations and 38 international organizations participate in ITU-T which is the body which sets world telecommunications standards (Recommendations).

The approval of Recommendations by the Members of ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, 1993). In addition, the World Telecommunication Standardization Conference (WTSC), which meets every four years, approves Recommendations submitted to it and establishes the study programme for the following period.

In some areas of information technology, which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC. The text of ITU-T Recommendation T.417 was approved by the WTSC (Helsinki, March 1-12, 1993. The identical text is also published as ISO/IEC International Standard 8613-7.

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

SUMMARY

This Recommendation is one of the Recommendations of the T.410-Series. It defines the raster graphics content architecture used to include images in a document. Image coding methods used in the raster graphics content architecture include methods used in the facsimile environments as well as methods used in non-facsimile environments.

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.

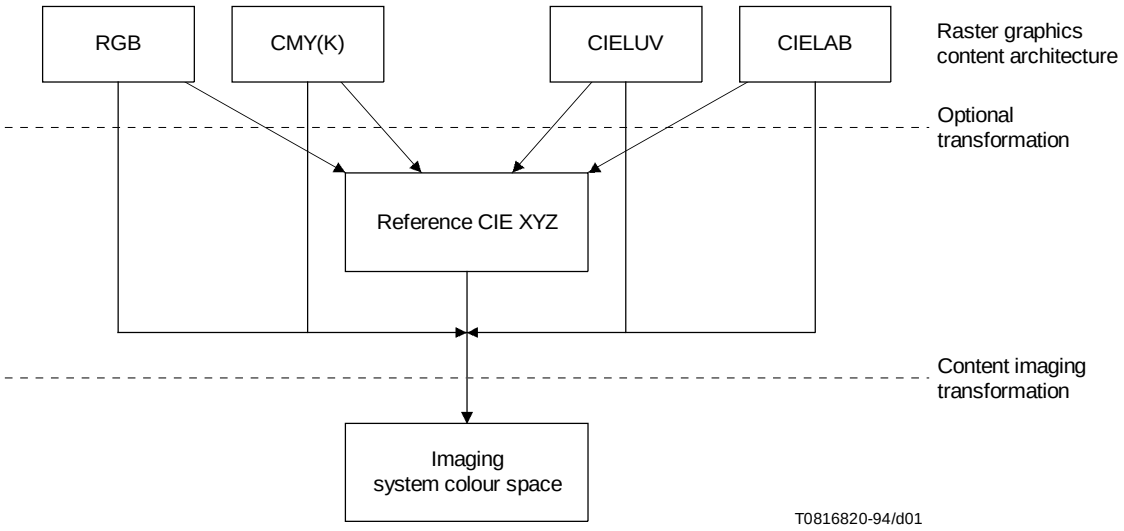


Figure 1 – Relationships among the colour spaces for the raster graphics content architecture

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).

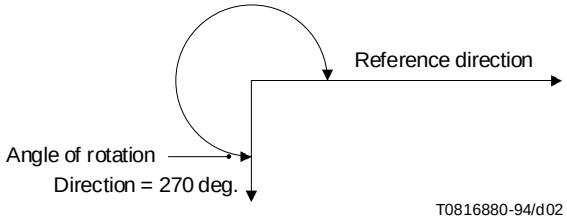


Figure 2 – Example of direction

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.

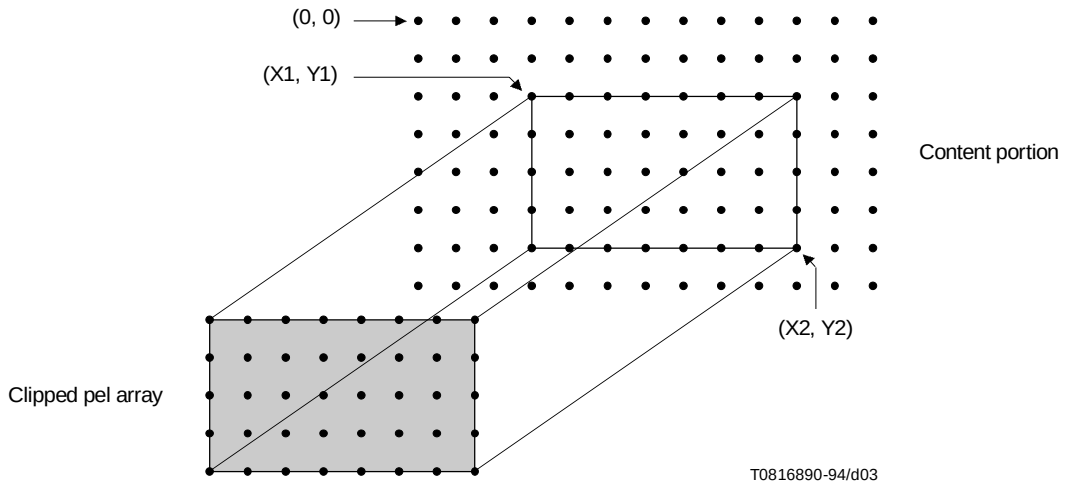
7.3 Positioning of pels

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 $X1 \leq 2$ and $Y1 \leq Y2$. 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.

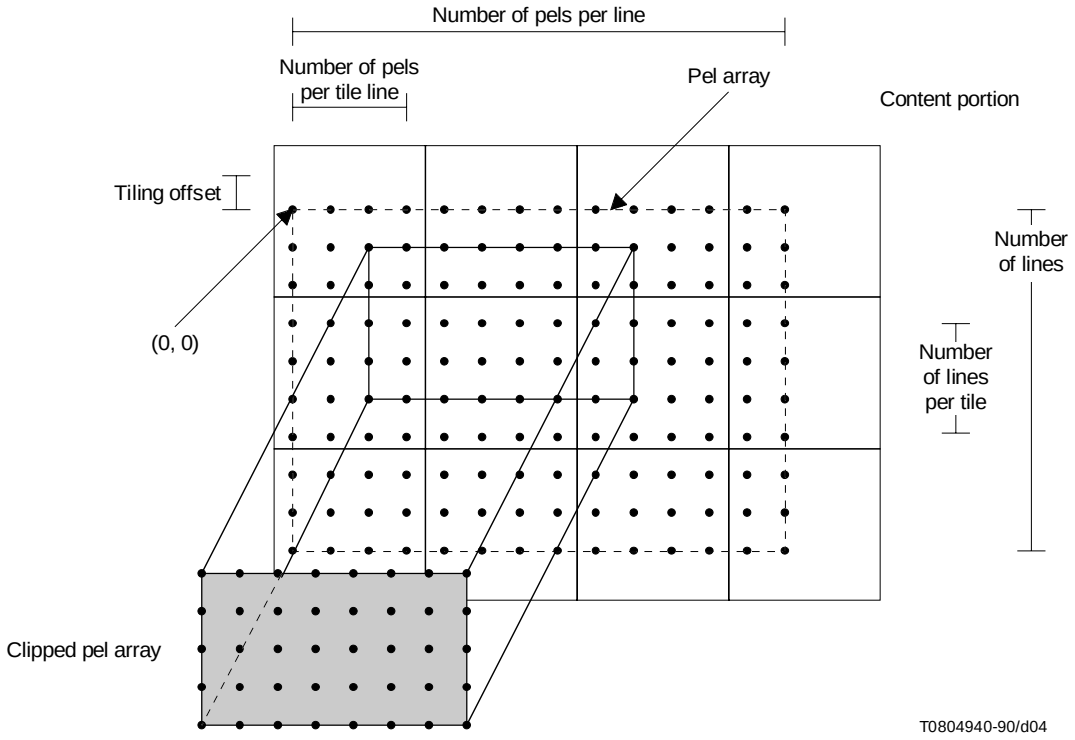


Figure 4 – Location of the pel array in the set of tiles

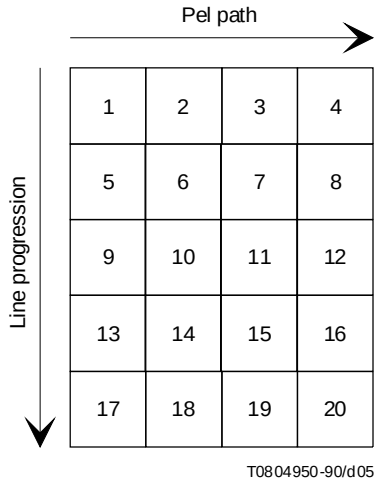


Figure 5 – Example of tile content ordering

7.5 Positioning of pels in a basic layout object

7.5.1 Positioning parameters

As illustrated in Figure 6, the positioning of pels within a basic layout object is determined by the following parameters:

- initial point;
- pel path;
- line progression;

– pel spacing;
– line spacing.

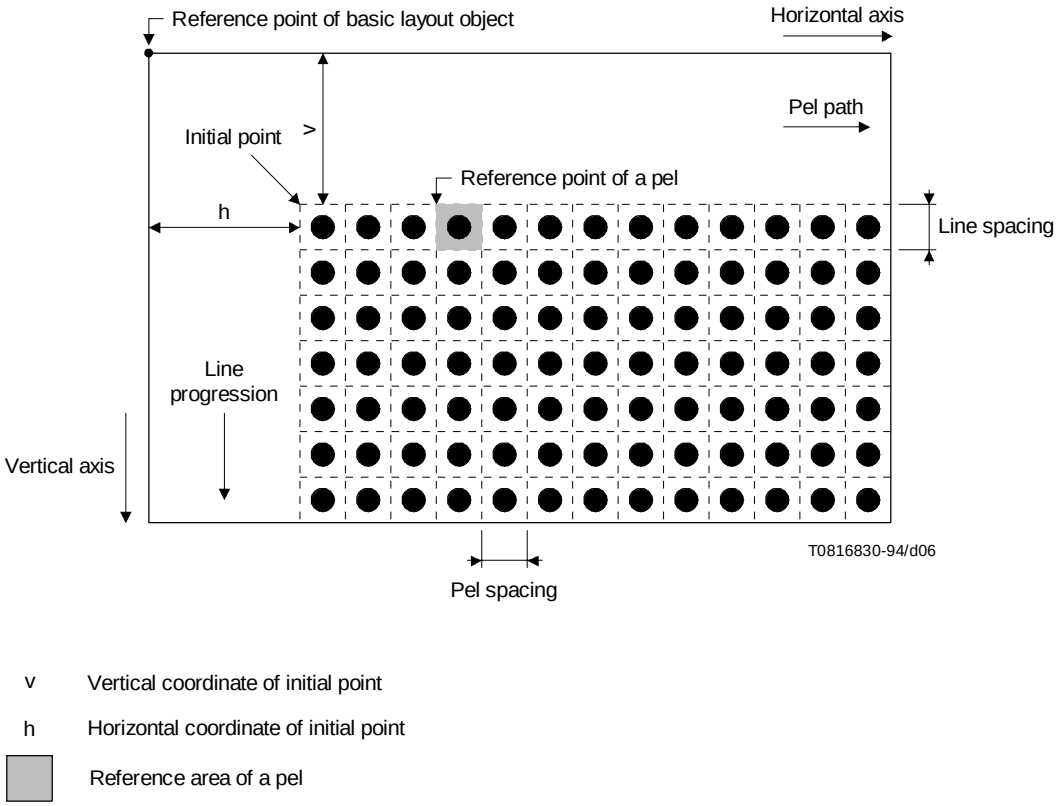


Figure 6 – Positioning of pels of the clipped pel array within a basic layout object

These properties of a raster image remain constant within the content associated with a particular basic layout object.

The general use of these properties when positioning pels is described below and illustrated in Figure 6. The particular applicability of these parameters to formatted and formatted processable form content is described in 7.5.2 and 7.5.3 respectively.

The *initial point* is the point relative to which all pels are positioned within a basic layout object.

The value of the initial point is a coordinate pair (h,v), where h and v are the horizontal and vertical distances respectively, of the initial point from the reference point of the basic layout object.

The *pel path* is the direction of progression of successive pels along a line and is expressed as a direction relative to the horizontal axis of the page coordinate system (as defined in ITU-T Rec. T.412 | ISO/IEC 8613-2).

Line progression is the direction of progression of successive lines and is expressed as a direction relative to the pel path.

Lines of pels are positioned such that the first pel to be positioned on each line falls on an imaginary line through the initial point in the direction of line progression.

The *pel spacing* is the distance between two adjacent pels along a line in the direction of the pel path.

The *line spacing* is the distance between adjacent pels in the direction of line progression. The line spacing may be less than, greater than or equal to the pel spacing.

The *spacing ratio* is defined as the ratio of the line spacing to the pel spacing.

The *aspect ratio* of a clipped pel array that has been positioned in a basic layout object is defined as the ratio of the dimension of the pel array in the direction of the pel path to the dimension in the direction of line progression.

The first pel of the clipped pel array is positioned at the initial point.

Each pel on the first line is positioned along a line through the initial point in the direction of the pel path.

The first pel of each line is positioned along a line through the initial point in the direction of line progression.

7.5.2 Positioning rules for formatted content

For this form of content, the positioning parameters are explicitly specified by applicable presentation attributes (see clause 8).

It is not possible to define a clipped pel array when using this form of content. However, a coding attribute can be used to indicate that a specified number of pels are to be discarded at the beginning and end of each line of the content portion. In this case, only the remaining pels in the content position are considered for positioning.

The line spacing and pel spacing are both specified by the same presentation attribute, and take the same value from the limited set of values specified in 8.2.2.

The initial point can be positioned anywhere inside or outside the basic layout object. Its default position (see 8.2.1) is the corner of the basic layout object in the direction opposite to both pel path and line progression.

All the pels within a content portion are to be considered for positioning (apart from any pels that are to be discarded). However, pels that would be positioned outside the basic layout object are not to be imaged by the imaging process.

7.5.3 Positioning rules for formatted processable content

For this form of content, the positioning parameters are determined from information specified in presentation and coding attributes and from the dimensions of the basic layout object.

The clipped pel array is specified by a presentation attribute, which selects the portion of the content portion to be positioned.

The pel path and line progression are explicitly specified by presentation attributes. The initial point is determined from the pel path and line progression specified, such that it is situated in the corner of the basic layout object in the direction opposite to both pel path and line progression (see Table 2); other values for the initial point cannot be specified.

The pel spacing is set to be equal to the dimension of the basic layout object in the direction of the pel path divided by the number of pels per line in the clipped pel array. Similarly, the line spacing is set to be equal to the dimension of the basic layout object in the direction of line progression divided by the number of lines in the clipped pel array.

Thus the clipped pel array is positioned within the basic layout object such that the reference areas of all the pels completely fill the basic layout object. None of the pels in the clipped pel array may be positioned outside of the basic layout object.

8 Definition of raster graphics presentation attributes

Presentation attributes specify the initial conditions relating to the layout and imaging of the content of a basic component. They may be specified for basic logical and layout components and for presentation styles.

There are three categories of raster graphics presentation attributes:

- Logical presentation attributes which take effect during the content layout process, but are ignored during the content imaging process.
- Layout presentation attributes which take effect during the content imaging process. Their values are generated either by the content layout process, or by a process that creates or edits the content.
- Shared presentation attributes which take effect during either or both the content layout and imaging processes.

These attributes are listed in Table 1.

Table 1 – Raster graphics presentation attributes

Shared attributes	Layout attributes	Logical attributes
Pel path	Pel transmission density	Pel spacing
Line progression	Initial offset	Spacing ratio
Clipping		Image dimensions

For each presentation attribute a default value is defined. This value is used in the defaulting mechanism as defined in ITU-T Rec. T.412 | ISO/IEC 8613-2.

This clause also defines values specific to raster graphics content architectures for the attribute "content architecture class" as defined in ITU-T Rec. T.412 | ISO/IEC 8613-2.

8.1 Shared presentation attributes

8.1.1 Clipping

CATEGORY:	Shared	
APPLICABILITY:	Formatted processable content architecture class	
STRUCTURE:	First coordinate pair:	X coordinate, Y coordinate
	second coordinate pair:	X coordinate, Y coordinate
PERMISSIBLE VALUES:	First coordinate pair:	non-negative integer, non-negative integer
	second coordinate pair:	non-negative integer, non-negative integer
DEFAULT VALUES:	First coordinate pair:	(0,0)
	second coordinate pair:	(N-1,L-1) where: N is the number of pels per line L is the number of lines

DEFINITION:

This attribute determines the sub-region of the pel array, as described by the content portion, which is to be considered by the content layout process and the content imaging process.

This attribute consists of two coordinate pairs. The first pair specifies the first pel that is part of the selected array. The second pair specifies the last pel that is part of the selected array.

Each coordinate of the first pair shall be less than or equal to the corresponding coordinate of the second pair.

8.1.2 Line progression

CATEGORY:	Shared
APPLICABILITY:	Formatted and formatted processable content architecture classes
PERMISSIBLE VALUES:	d90, d270
DEFAULT VALUE:	d270

DEFINITION:

This attribute specifies the direction of the progression of successive lines, relative to the pel path.

8.1.3 Pel path

CATEGORY:	Shared

APPLICABILITY: Formatted and formatted processable content architecture classes

PERMISSIBLE VALUES: d0, d90, d180, d270

DEFAULT VALUE: d0

DEFINITION:

This attribute specifies the direction of the progression of successive pels along a line, relative to the horizontal axis of the basic layout object.

8.2 Layout presentation attributes

8.2.1 Initial offset

CATEGORY: Layout

APPLICABILITY: Formatted content architecture class

STRUCTURE: Two parameters: "horizontal coordinate", "vertical coordinate"

PERMISSIBLE VALUES: horizontal coordinate: any integer
vertical coordinate: any integer

DEFAULT VALUES: The default value of this attribute depends on the pel path and line progression as defined in Table 2

DEFINITION:

This attribute specifies the position of the initial point relative to the basic layout object.

The parameters "horizontal coordinate" and "vertical coordinate" specify the horizontal and vertical coordinates, in SMUs, of the initial point relative to the reference point of the basic layout object. The value of each coordinate should be positive or zero.

NOTE – The facility to specify negative coordinate values for the initial point is not intended to be used. It was provided for use with content architectures based on CCITT Recommendation T.73, which is no longer valid.

Table 2 – Default values of the presentation attribute "initial offset" (position of initial point)

Pel path	Line progression	Horizontal coordinate (SMU)	Vertical coordinate (SMU)
d0	d270	0	0
	d90	0	BDV
d270	d270	BDH	0
	d90	0	0
d180	d270	BDH	BDV
	d90	BDH	0
d90	d270	0	BDV
	d90	BDH	BDV

BDV Vertical dimension of block

BDH Horizontal dimension of block

8.2.2 Pel transmission density

CATEGORY: Layout

APPLICABILITY: Formatted content architecture class

PERMISSIBLE VALUES: 1, 2, 3, 4, 5, 6 BMU

DEFAULT VALUE: 6 BMU

DEFINITION:

This attribute specifies a single value for both the pel spacing and the line spacing

NOTE – The correspondence between pel spacing, line spacing and resolution is shown in Table 3.

Table 3 – Relation of pel spacing and line spacing to resolution

Pel spacing and line spacing in BMU	Resolution in number of pels per 1 200 BMU
6	200
5	240
4	300
3	400
2	600
1	1 200

8.3 Logical presentation attributes

8.3.1 Image dimensions

CATEGORY: Logical

APPLICABILITY: Formatted processable content architecture class

STRUCTURE: One of four parameters:

a) “width controlled” with sub-parameters:
“minimum width”
“preferred width”

b) “height controlled” with sub-parameters:
“minimum height”
“preferred height”

c) “area controlled” with sub-parameters:
“minimum width”
“preferred width”
“minimum height”
“preferred height”
“aspect ratio flag”

d) “automatic” with no sub-parameters

PERMISSIBLE VALUES:

“minimum width”: non-negative integer
“preferred width”: non-negative integer
“minimum height”: non-negative integer
“preferred height”: non-negative integer
“aspect ratio flag”: ‘fixed’, ‘variable’

“automatic” with the value ‘null’

DEFAULT VALUE: "automatic".

DEFINITION:

This attribute specifies the intended dimensions of the basic layout object that is to contain the clipped pel array.

The values of "minimum width" and "preferred width" specify, respectively, the lower limit and the upper limit of the allowed dimensions of the basic layout object in the direction of the pel path. The value of the 'minimum width' shall not to be greater than the value of the 'preferred width'.

The values of "minimum height" and "preferred height" specify, respectively, the lower limit and the upper limit of the dimensions of the basic layout object in the direction of the line progression. The value of the 'minimum height' shall not to be greater than the value of the 'preferred height'.

If either or both of the values of the preferred parameters are specified, the corresponding dimensions of the basic layout object are required to be as close to these values as possible.

If only the range of allowed widths is specified [see case a)], this attribute specifies that the height shall be such that the aspect ratio of the clipped pel array is maintained.

If only the range of allowed heights is specified [see case b)], this attribute specifies that the width shall be such that the aspect ratio of the clipped pel array is maintained.

If both the ranges of allowed widths and heights are specified [see case c)] the value of 'aspect ratio flag' determines whether or not the aspect ratio of the clipped pel array shall be maintained during the determination of the dimensions of the basic layout object.

If neither the range of allowed heights nor the range of allowed widths is specified (case d), this attribute specifies that the aspect ratio of the basic layout object shall be the same as the aspect ratio of the clipped pel array, and also that the dimension of the basic layout object in the direction of the pel path shall be equal to the dimension of the available area in that direction.

All parameters specifying a width or height are specified in SMUs.

8.3.2 Pel spacing

CATEGORY:	Logical	
APPLICABILITY:	Formatted processable content architecture class	
STRUCTURE:	Two parameters:	"length" "pel spaces"
	or the value:	"null"
PERMISSIBLE VALUES:	"length": "pel spaces": "null"	positive integer positive integer
DEFAULT VALUE:	"length": "pel spaces":	4 1

DEFINITION:

This attribute specifies the method for determining the distance between successive pels along a line. The attribute consists of either the value "null", or the two parameters "length" (with integer value m) and "pel spaces" (with integer value n).

If the attribute has a value of "null" the scalable dimension content layout method is followed.

If the attribute consists of the two parameters, the ratio of the integers m and n (m/n) specifies the spacing in SMUs between two successive pels, and the fixed dimension content layout method is followed.

NOTE – The scalable and fixed dimension content layout methods are described in clause 12.3 and 12.4.

8.3.3 Spacing ratio

CATEGORY:	Logical	
APPLICABILITY:	Formatted processable content architecture class	
STRUCTURE:	Two parameters:'	"line spacing value" "pel spacing value"
PERMISSIBLE VALUES:	"line spacing value": "pel spacing value":	positive integer positive integer

DEFAULT VALUE:	"line spacing value":	1
	"pel spacing value":	1

DEFINITION:

This attribute specifies the ratio between the line spacing and the pel spacing of the image represented by the content portion. This ratio is to be observed by the raster graphics content layout process (defined in clause 12) in determining the block size, and by the imaging process (defined in clause 13) to avoid image distortion.

This attribute consists of two parameters, the "line spacing value" and the "pel spacing value", the ratio of which is the ratio of the line spacing to the pel spacing.

The attribute "spacing ratio" is only applicable when the value of the parameter "aspect ratio flag" in the attribute "image dimensions" is set to 'fixed'.

8.4 Content architecture class attributes

8.4.1 Content architecture class

The value of the attribute "content architecture class" of a basic component description that conforms to this Specification is an ASN.1 object identifier with one of the following values:

{ 2 8 2 7 0 } for the formatted raster graphics content architecture class;

{ 2 8 2 7 2 } for the formatted raster graphics processable content architecture class.

9 Definition of raster graphics content portion attributes

According to ITU-T Rec. T.412 | ISO/IEC 8613-2, content portion attributes consist of four categories:

- identification attributes;
- common coding attributes;
- coding attributes;
- content information attributes.

The identification attributes are completely defined in ITU-T Rec. T.412 | ISO/IEC 8613-2.

The common coding attributes are described in ITU-T Rec. T.412 | ISO/IEC 8613-2; attribute values that are specific to raster graphics content architectures are specified in 9.1.

Other coding attributes are defined in 9.2 and the format of the content information, i.e. the possible values of the attribute "content information", is specified in 9.3.

9.1 Common coding attributes

9.1.1 Type of coding

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted and formatted processable content architecture class
STRUCTURE:	ASN.1 object identifier or non-negative integer.
PERMISSIBLE VALUES:	The permissible values for this attribute depend on the value of the attribute "bits per colour component" as follows:
	"bits per colour component" = 1:
	ASN.1 object identifier: { 2 8 3 7 0 } for 'Rec. T.6 encoding', { 2 8 3 7 1 } for 'Rec. T.4 one-dimensional encoding', { 2 8 3 7 2 } for 'Rec. T.4 two-dimensional encoding', { 2 8 3 7 3 } for 'bitmap encoding', { 2 8 3 7 5 } for 'tiled encoding', { 2 8 3 7 6 } for 'Rec. T.6 encoding – MSB', { 2 8 3 7 7 } for 'Rec. T.4 one-dimensional encoding – MSB', { 2 8 3 7 8 } for 'Rec. T.4 two-dimensional encoding – MSB',

non-negative integer:

1 for ‘Rec. T.6 encoding’.

“bits per colour component” > 1:

ASN.1 object identifier:
{ 2 8 3 7 9 } for ‘direct value encoding’,
{ 2 8 3 7 10 } for ‘octet run-length encoding’,
{ 2 8 3 7 11 } for ‘packed index encoding’.

NOTE – The use of ‘Rec. T.6 encoding – MSB’; ‘Rec. T.4 one-dimensional encoding – MSB’; and ‘Rec. T.4 two-dimensional encoding – MSB’ is applicable to ITU-T Rec. T.417 only.

DEFAULT VALUE: The permissible values for this attribute depend on the value of the attribute “bits per colour component” as follows:

“bits per colour component” = 1:
‘Rec. T.6 encoding’,

“bits per colour component” > 1
for further study

DEFINITION:

For the raster graphics content architectures, the possible values of this attribute are

- ‘Rec. T.6 encoding’, for the two-dimensional encoding scheme defined in CCITT Rec. T.6;
- ‘Rec. T.4 one-dimensional encoding’, for the one-dimensional encoding scheme defined in ITU-T Rec. T.4;
- ‘Rec. T.4 two-dimensional encoding’, for the two-dimensional encoding scheme defined in ITU-T Rec. T.4;
- ‘bitmap encoding’;
- ‘Rec. T.6 encoding – MSB’, for the two-dimensional encoding scheme defined in CCITT Rec. T.6 and where the first bit of the encoded T.6 data is allocated to the most significant bit of the first octet;
- ‘Rec. T.4 one-dimensional encoding – MSB’, for the one-dimensional encoding scheme defined in ITU-T Rec. T.4 and where the first bit of the encoded T.4 data is allocated to the most significant bit of the first octet;
- ‘Rec. T.4 two-dimensional encoding – MSB’, for the two-dimensional encoding scheme defined in ITU-T Rec. T.4 and where the first bit of the encoded T.4 data is allocated to the most significant bit of the first octet;
- ‘tiled encoding’ for the tiling scheme defined in this Specification, the bitmap encoding scheme, the two-dimensional coding scheme defined in CCITT Rec. T.6, or the one- or two-dimensional coding schemes defined in ITU-T Rec. T.4, the two-dimensional coding scheme defined in CCITT Rec. T.6 with MSB mapping, or the one- or two-dimensional coding schemes defined in ITU-T Rec. T.4 with MSB mapping;
- ‘direct value encoding’;
- ‘octet run-length encoding’;
- ‘packed index encoding’.

An explanation of these coding schemes is given in clause 11.

The value ‘tiled encoding’ indicates that the tiles in the content portion description are each encoded per the value of the associated “tile types” attribute as defined in 9.2.8.

The value of the attribute “type of coding” of a content portion description, that conforms to this Specification, is an ASN.1 object identifier or an integer.

In coding, the relationship between the order of pels and the order of bits within an octet is such that the first pel in the order of bits is allocated to the most significant bit of an octet.

The relationship between the order of pels, the order of encoded bits and the order of encoded octets is the same for tiled, as for untiled bitmap, Rec. T.4, Rec. T.4 – MSB, Rec. T.6 and Rec. T.6 – MSB encoding.

9.2 Other coding attributes

These attributes provide information required for encoding and decoding the content information, as well as other information that is intrinsic to the content portion and required by the content layout and imaging processes.

9.2.1 Compression

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted and formatted processable content architecture class
PERMISSIBLE VALUES:	‘compressed’, ‘uncompressed’
DEFAULT VALUE:	‘compressed’

DEFINITION:

This attribute indicates if the code extension technique for uncompressed mode is present in the content portion. This attribute can have one of two values:

– ‘compressed’ indicates that the code extension technique for uncompressed mode is not used;

– ‘uncompressed’ indicates that the code extension technique for uncompressed mode may be used.

NOTE – Basic mode (compressed) encoding is used initially for coding all such content portions. The occurrence of the code extension technique for uncompressed mode coding results in subsequent content being coded in uncompressed mode.

This attribute is only applicable if the value of the attribute “type of coding” is ‘Rec. T.6 encoding’ or ‘Rec. T.4 two-dimensional encoding’.

9.2.2 Number of lines

CLASSIFICATION:	Non-mandatory
APPLICABILITY:	Formatted processable content architecture class
PERMISSIBLE VALUES:	Positive integer

DEFINITION:

This attribute specifies the number of lines of pels within a content portion.

NOTE – This attribute takes effect during the content layout process.

9.2.3 Number of pels per line

CLASSIFICATION:	Defaultable for components of the formatted content architecture class; Mandatory for components of the formatted processable content architecture class
APPLICABILITY:	Formatted and formatted processable content architecture classes
PERMISSIBLE VALUES:	Non-negative integer
DEFAULT VALUE:	The default value for components of the formatted content architecture class depends upon the “pel transmission density” as specified in Table 4. No default value is specified for components of the formatted processable content architecture class

DEFINITION:

This attribute specifies the number of pels in each line within a content portion.

Table 4 – Default value of the presentation attribute "number of pels per line"

Pel transmission density (BMU)	Default number of pels per line
1	10 368
2	5 184
3	3 456
4	2 592
5	2 074
6	1 728

9.2.4 Number of discarded pels

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted content architecture class
PERMISSIBLE VALUES:	non-negative integer
DEFAULT VALUE:	If the number of pels per line exceeds the number that can be placed within the available area by use of the reference imaging process specified in clause 13, then the default value is half the excess number of pels, otherwise it is 0.

DEFINITION:

This attribute specifies the number of pels that are to be ignored at the beginning of each line within a content portion. The positioning of each line is started from the next pel in the line.

9.2.5 Number of lines per tile

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted processable content architecture class
PERMISSIBLE VALUE:	Positive integer
DEFAULT VALUE:	512

DEFINITION:

This attribute specifies the tile dimension in units of line spaces in the direction of line progression.

This attribute is only applicable if the value of the attribute "type of coding" is 'tiled encoding'.

9.2.6 Number of pels per tile line

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted processable content architecture class
PERMISSIBLE VALUE:	Positive integer
DEFAULT VALUE:	512

DEFINITION:

This attribute specifies the tile dimension in units of pel spaces in the pel path direction.

This attribute is only applicable if the value of the attribute "type of coding" is 'tiled encoding'.

9.2.7 Tiling offset

CLASSIFICATION:	Defaultable

APPLICABILITY:	Formatted processable content architecture class	
STRUCTURE:	Coordinate pair:	X coordinate, Y coordinate
PERMISSIBLE VALUES:	Coordinate pair non-negative integer less than the value of the attribute “number of pels per tile line”	
	non-negative integer less than the value of the attribute “number of lines per tile”	
DEFAULT VALUE:	(0,0)	

DEFINITION:

This attribute specifies the location of the pel array within the tile space by defining the offset of the first pel of the pel array from the first pel position of the first tile. The offset is specified in pel spaces in the direction of the pel path and line spaces in the direction of the line progression.

All tiles cover a portion of the pel array. Portions of the tile space outside the pel array are artifacts of tiling and contain no information.

This attribute is only applicable if the value of the attribute “type of coding” is ‘tiled encoding’.

9.2.8 Tile types

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted processable content architecture class
PERMISSIBLE VALUES:	A sequence of one or more data elements with one of the following values: ‘null background’, ‘null foreground’, ‘bitmap encoded’, ‘Rec. T.6 encoded’, ‘Rec. T.4 one-dimensional encoded’, ‘Rec. T.4 two-dimensional encoded’ ‘Rec. T.6 encoded – MSB’, ‘Rec. T.4 one-dimensional encoded – MSB’, ‘Rec. T.4 two-dimensional encoded – MSB’ ‘packed index encoding’ ‘direct value encoding’ ‘octet run-length encoding’
DEFAULT VALUE:	All tiles are Rec. T.6 encoded

DEFINITION:

This attribute indicates the type of coding of tiles in the content portion as a sequence of values. Each value specifies the type of coding of the corresponding tile (see Figure 6) in the content portion as follows:

- ‘null background’, indicating that all pels in the tile are known to be background and the tile has no encoded content;
- ‘null foreground’, indicating that all pels in the tile are known as foreground and the tile has no encoded content;
- ‘Rec. T.6 encoded’, indicating that the pels in the tile are encoded as a Rec. T.6 octet string;
- ‘Rec. T.4 one-dimensional encoded’, indicating that the pels in the tile are encoded as a Rec. T.4 one-dimensional octet string;
- ‘Rec. T.4 two-dimensional encoded’, indicating that the pels in the tile are encoded as a Rec. T.4 two-dimensional octet string;
- ‘Rec. T.6 encoded’, indicating that the pels in the tile are encoded as a Rec. T.6 octet string;
- ‘Rec. T.4 one-dimensional encoded – MSB’, indicating that the pels in the tile are encoded as a Rec. T.4 one-dimensional octet string;
- ‘Rec. T.4 two-dimensional encoded – MSB’, indicating that the pels in the tile are encoded as a Rec. T.4 two-dimensional octet string;
- ‘bitmap encoded’, indicating that the pels in the tile are encoded as a bitmap octet string;

- packed index encoding;
- direct value encoding;
- octet run-length encoding.

The number of values is equal to the number of tiles.

This attribute is only applicable if the value of the attribute “type of coding” is ‘tiled encoding‘.

9.2.9 Bits per colour component

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted and formatted processable content architecture class
PERMISSIBLE VALUES:	A positive integer, or a sequence of non-negative integers.
DEFAULT VALUE:	1

DEFINITION:

This attribute defines the number of bits used to represent each colour component of the image. If the value is specified as a single integer, then that value applies to each component. Otherwise, each integer in the sequence specifies the number of bits in the corresponding component.

Where a sequence of integers is specified, a zero value indicates that the corresponding colour component is not present in this image. At least one value in the sequence shall be non-zero.

9.2.10 Interleaving format

CLASSIFICATION:	Defaultable
APPLICABILITY:	Formatted and formatted processable content architecture class
PERMISSIBLE VALUES:	‘pel’, ‘line’, ‘plane’
DEFAULT VALUE:	‘plane’

DEFINITION:

This attribute defines the method of interleaving of the components of the image. The values are defined as follows:

‘pel’ for each pel, the colour component values are contiguous;

‘line’ for each colour component, all values corresponding to each pel on a line are contiguous;

‘plane’ for each colour component, all values corresponding to that component are contiguous.

9.3 Content information attributes

For raster graphics content architectures, the value of the “content information” attribute is an octet string, or a sequence of octet strings in the case of tiled encoding, representing a pel array encoded according to the value of the attribute “type of coding”.

9.4 Interactions with document architecture attributes

The layout directives “indivisibility” and “concatenation” are not taken into account during the layout of raster graphics content associated with a basic logical component.

10 Formal definitions of raster graphics content architecture dependent data types

10.1 Introduction

This clause contains formal definitions in ASN.1 notation (defined in ISO/IEC 8824) of the data types corresponding to presentation and coding attributes that are applicable to raster graphics content architectures:

Normative Annex C (to ISO/IEC 8613-7) contains the SGML representation of the attributes specific to raster graphics content architectures.

These data types are:

- the data type to represent raster graphics content architecture specific presentation attributes in basic layout components, presentation styles and default value lists;
- the data type to represent raster graphics content architecture specific coding attributes in content portions;
- the data type to represent non-basic values of raster graphics content architecture presentation attributes in the document profile;
- the data type to represent non-basic values of raster graphics content architecture coding attributes in the document profile;
- the data type to represent non-standard default values of raster graphics content architecture presentation and coding attributes in the document profile.

10.2 Representation of presentation attributes

The data type **Raster-Graphics-Attributes** contains a set of subordinate data types that specify the raster graphics presentation attributes. Some of these subordinate data types are elementary but others are structured and are themselves made up of subordinate data types. The format of these data types is given below.

The subset of subordinate data types that may occur within a particular instance of the data type **Raster-Graphics-Attributes** depends upon the particular raster graphics content architecture level that is specified.

```
Raster-Gr-Presentation-Attributes { 2 8 1 7 2 }

DEFINITIONS ::= BEGIN

EXPORTS

        Raster-Graphics-Attributes,
        Clipping,
        Measure-Pair,
        One-Of-Four-Angles,
        One-Of-Two-Angles,
        Pel-Transmission-Density,
        Pel-Spacing,
        Spacing-Ratio,
        Coordinate-Pair;

Raster-Graphics-Attributes      ::= SET {
   pel-path                         [0] IMPLICIT One-Of-Four-Angles OPTIONAL,
   line-progression                 [1] IMPLICIT One-Of-Two-Angles OPTIONAL,
   pel-transmission-density         [2] IMPLICIT Pel-Transmission– Density OPTIONAL,
   initial-offset                   [3] IMPLICIT Measure-Pair OPTIONAL,
   clipping                         [4] IMPLICIT Clipping OPTIONAL,
   pel-spacing                      [5] Pel-Spacing OPTIONAL,
   spacing-ratio                    [6] IMPLICIT Spacing-Ratio OPTIONAL,
   image-dimensions                 [7] Image-Dimensions OPTIONAL }

One-Of-Four-Angles              ::= INTEGER {
                                    d0 (0), – – d0
                                    d90 (1), – – d90
                                    d180 (2), – – d180
                                    d270 (3) – – d270
                                          }

One-Of-Two-Angles               ::= INTEGER {
                                    d90 (1), – – d90
                                    d270 (3) – – d270
                                          }

Pel-Transmission-Density        ::= INTEGER {
                                    p6 (1), – – 6 BMU
                                    p5 (2), – – 5 BMU
                                    p4 (3), – – 4 BMU
                                    p3 (4), – – 3 BMU
                                    p2 (5), – – 2 BMU
                                    p1 (6) – – 1 BMU
                                          }

Measure-Pair                    ::= SEQUENCE {
```

```
    horizontal                      [0] IMPLICIT INTEGER,
    vertical                        [0] IMPLICIT INTEGER }

Clipping                        ::= SEQUENCE {
    first-coordinate-pair               [0] IMPLICIT Coordinate-Pair OPTIONAL,
    second-coordinate-pair              [1] IMPLICIT Coordinate-Pair OPTIONAL }

Coordinate-Pair                 ::= SEQUENCE {
    x-coordinate                    INTEGER,
    y-coordinate,                   INTEGER },

Pel-Spacing                     ::= CHOICE {

spacing                         [0] IMPLICIT SEQUENCE {
    length                      INTEGER,
    pel-spaces                  INTEGER },

null                            [1] IMPLICIT NULL }

Spacing-Ratio                   ::= SEQUENCE {
    line-spacing-value                  INTEGER,
    pel-spacing-value                   INTEGER },

Image-Dimensions                ::= CHOICE {

width-controlled                [0] IMPLICIT SEQUENCE {
    minimum-width               INTEGER,
    preferred-width             INTEGER },

height-controlled               [1] IMPLICIT SEQUENCE {
    minimum-height                      INTEGER,
    preferred-height                    INTEGER },

area-controlled                 [2] IMPLICIT SEQUENCE {
    minimum-width                       INTEGER,
    preferred-width                     INTEGER,
    minimum-height                      INTEGER,
    preferred-height                    INTEGER,
    aspect-ratio-flag                   INTEGER {
                                            fixed (0),
                                            variable (1) } },

automatic                       [3] IMPLICIT NULL }

END
```

NOTE – The following types are also defined in other parts of the ITU-T Rec. T.410-Series | ISO/IEC 8613: 'One-Of-Four-Angles', 'One-Of-Two-Angles', 'Measure-Pair'.

10.3 Representation of coding attributes

```
Raster-Gr-Coding-Attributes { 2 8 1 7 3 }

DEFINITIONS                     ::= BEGIN

EXPORTS
    Raster-Gr-Coding-Attributes,
    Compression,
    Tile-Type;

IMPORTS

        Coordinate-Pair

    FROM

        Raster-Gr-Presentation-Attributes;

Raster-Gr-Coding-Attributes     ::= SET {
    number-of-pels-er-line              [0] IMPLICIT INTEGER OPTIONAL,
    number-of-lines                     [1] IMPLICIT INTEGER OPTIONAL,
    compression                         [2] IMPLICIT Compression OPTIONAL,
    number-of-discarded-els             [3] IMPLICIT INTEGER OPTIONAL,
    bits-per-colour-omponent            [4] Bits-Per-Colour-Component OPTIONAL,
    interleaving-format                 [5] IMPLICIT INTEGER
                                          { pel(0), line(1), plane(2) } OPTIONAL },
```

```
    number-of-pels-er-tile-line          [6] IMPLICIT INTEGER OPTIONAL,
    number-of-lines-er-title             [7] IMPLICIT INTEGER OPTIONAL,
    tiling-offset                        [8] IMPLICIT Coordinate-Pair OPTIONAL,
    tile-types                           [9] IMPLICIT SEQUENCE OF Tile-Type
                                                 OPTIONAL

Compression                    ::= INTEGER { uncompressed (0), compressed (1) }

Tile-type                      ::= INTEGER {
                                       null-background                (0),
                                       null-foreground                (1),
                                       T.6-encoded                    (2),
                                       T.4-one-dimensional-encoded    (3),
                                       T.4-two-dimensional-encoded    (4),
                                       bitmap-encoded                 (5)
                                       T.6-encoded–msb                (6),
                                       T.4-one-dimensional-encoded–msb (7),
                                       T.4-two-dimensional-encoded–msb (8),
                                       packed-index-encoding          (9),
                                       direct-value-encoding          (10),
                                       octet-run-length-encoding      (11) }

Bits-Per-Colour-Component      ::= CHOICE {

component-list                         single-integer     INTEGER,
                                       component-list     SEQUENCE OF INTEGER }

END
```

10.4 Representation of non-basic features and non-standard defaults

```
Raster-Gr-Profile-Attributes { 2 8 1 7 4 }

DEFINITIONS                    ::= BEGIN

   EXPORTS
      Ra-Gr-Presentation-Feature, Ra-Gr-Coding-Attribute,
      Raster-Gr-Content-Defaults;

   IMPORTS
            One-Of-Four-Angles,
            One-Of-Two-Angles,
            Pel-Transmission-Density,
            Measure-Pair,
            Clipping,
            Pel-Spacing,
            Spacing-Ratio,
            Image-Dimensions,
            Coordinate-Pair,
            Raster-Graphics-Attributes,
            FROM Raster-Gr-Presentation-Attributes,
            Compression,
            Tile-Type,
            FROM Raster-Gr-Coding-Attributes;

Ra-Gr-Presentation-Feature     ::= CHOICE {
   Initial-offset                      [3] IMPLICIT Measure-Pair,
   clipping                            [4] IMPLICIT Clipping,
   pel-spacing                         [5] Pel-Spacing,
   spacing-ratio                       [6] IMPLICIT Spacing-Ratio,
   image-dimensions                    [7] Image-Dimensions,
   pel-path                            [9] IMPLICIT One-Of-Four-Angles,
   line-progression                    [10] IMPLICIT One-Of-Two-Angles,
   pel-transmission-density            [11] IMPLICIT Pel-Transmission-Density }
      -- The tag values used above preserve compatibility
      -- with Group 4 Class I facsimile data streams.

Ra-Gr-Coding-Attributes        := CHOICE {
   compression                         [0] IMPLICIT Compression,
   number of pels-per-tile-line        [6] IMPLICIT INTEGER,
   number of lines-per-tile            [7] IMPLICIT INTEGER,
   tiling-offset                       [8] IMPLICIT Coordinate-Pair,
```

```
    tiling-types                        [9] IMPLICIT Tile-Type }
        -- The tag values used above preserve compatibility
        -- with Group 4 Class I facsimile data streams.

Raster-Gr-Content-Defaults              ::= SET {
                                        COMPONENTS OF Raster-Graphics-Attributes,
    compression                             [8] IMPLICIT Compression OPTIONAL,
    number-of-pels-per-tile-line            [11] IMPLICIT INTEGER OPTIONAL,
    number-of-lines-per-tile                [12] IMPLICIT INTEGER OPTIONAL,
    tiling-offset                           [13] IMPLICIT Coordinate-Pair
                                             OPTIONAL,
    tiling-type                             [14] IMPLICIT Tile-Type OPTIONAL }

END
```

11 Coding schemes

A pel array may be represented within a text unit by means of one of the following encoding schemes:

- CCITT Rec. T.6 encoding scheme;
- CCITT Rec. T.4 encoding schemes;
- CCITT Rec. T.6 encoding scheme – MSB;
- CCITT Rec. T.4 encoding schemes – MSB;
- bitmap encoding scheme;
- direct value encoding scheme;
- octet run-length encoding scheme;
- packed index encoding scheme.

11.1 CCITT Rec. T.6 encoding scheme

In this encoding scheme, a pel array is encoded according to CCITT Rec. T.6. The colours *black* and *white* referred to in that Recommendation should be interpreted as *foreground* and *background*, or *set* and *unset*, respectively.

This part of the ITU-T Rec. T.417 | ISO/IEC 8613-7 allows the encoding scheme in CCITT Rec. T.6 to be extended to allow the encoding of run lengths greater than 2623. That is, this extension allows run lengths of greater than 2623 to be encoded by allowing the concatenation of two or more Make-up codewords. Thus, when horizontal mode encoding is used in the Rec. T.6 encoding algorithm, run lengths of 64 or greater are encoded first by one or more Make-up codewords representing the run lengths equal to or shorter than the run required. The minimum number of Make-up codewords shall be used. This is then followed by a single Terminating codeword (as defined in Rec. T.6) representing the difference between the required run lengths and the run lengths represented by the Make-up codeword or codewords.

In addition, the encoded data belonging to each content portion shall be terminated by an EOFB (end-of-facsimile-block), the format of which is defined in CCITT Rec. T.6.

The bits in the bit string defined by CCITT Rec. T.6, commencing with the first bit, and proceeding to the trailing bit, shall be placed in bits 1 to 8 of the first octet, followed by bits 1 to 8 of each octet in turn, followed by as many bits as are needed of the final octet, commencing with bit 1. For the purposes of this definition, the bits of an octet are numbered from 8 to 1, where bit 8 is the *most significant bit*, and bit 1 is the *least significant bit*.

For Rec. T.6 – MSB encoding, the bits in the bit string defined by CCITT Rec. T.6, commencing with the trailing bit, and proceeding to the first bit, shall be placed in bits 1 to 8 of the first octet, followed by bits 1 to 8 of each octet in turn, followed by as many bits are needed of the final octet, commencing with bit 1. For the purposes of this definition, the bits of an octet are numbered from 8 to 1, where bit 8 is the *most significant bit*, and bit 1 is the *least significant bit*.

NOTE – The use of Rec. T.6 encoding – MSB is applicable to ITU-T Rec. T.417 only.

11.2 CCITT Rec. T.4 encoding schemes

In these encoding schemes, a pel array is encoded according the one or two-dimensional encoding schemes defined in CCITT Rec. T.4. The colours *black* and *white* referred to in that Recommendation should be interpreted as *foreground* and *background*, or *set* and *unset*, respectively.

This part of the ITU-T Rec. T.417 | ISO/IEC 8613-7 allows the encoding scheme in CCITT Rec. T.4 to be extended to allow the encoding of run lengths greater than 2623. That is, this extension allows run lengths of greater than 2623 to be

encoded by allowing the concatenation of two or more Make-up codewords. Thus, run lengths of 64 or greater are encoded first by one or more Make-up codewords representing the run lengths equal to or shorter than the run required. The minimum number of Make-up codewords shall be used. This is then followed by a single Terminating codeword representing the difference between the required run lengths and the run lengths represented by the Make-up codeword or codewords.

When using the T.4 one- or two-dimensional encoding scheme, the use of EOL is required to indicate the end of the encoding of each line of pels. In addition, the encoded data belonging to each content portion shall be terminated by an RTC (return to control), the format of which is defined in CCITT Rec. T.4. If the total number of bits belonging to a content portion is not a multiple of eight (i.e. an integral number of octets), then the RTC must be followed by the minimum number of '0' bits such that the last bit aligns on an octet boundary.

When using the two-dimensional encoding scheme, any number of fill bits and any value of K-parameter may be used without declaration in the coding attributes.

The bits in the bit string defined by CCITT Rec. T.4, commencing with the first bit, and proceeding to the trailing bit, shall be placed in bits 1 to 8 of the first octet, followed by bits 1 to 8 of each octet in turn, followed by as many bits are needed of the final octet, commencing with bit 1. For the purposes of this definition, the bits of an octet are numbered from 8 to 1, where bit 8 is the *most significant bit,* and bit 1 is the *least significant bit.*

For Rec. T.4 – MSB encodings, the bits in the bit string defined by CCITT Rec. T.4, commencing with the trailing bit, and proceeding to the first bit, shall be placed in bits 1 to 8 of the first octet, followed by bits 1 to 8 of each octet in turn, followed by as many bits as are needed of the final octet, commencing with bit 1. For the purposes of this definition, the bits of an octet are numbered from 8 to 1, where bit 8 is the *most significant bit*, and bit 1 is the *least significant bit*.

NOTE – The use of Rec. T.4 encodings – MSB is applicable to ITU-T Rec. T.417 only.

11.3 Bitmap encoding scheme

Each element in a pel array may have one of two distinct states. These are the set state, corresponding to foreground colour and the unset state, corresponding to background colour. For the purpose of representing such an array within a content portion, each pel may be represented by a single bit which has the value '0' or '1' depending on the state of that pel. If the pel has the unset state, the value of the bit is '0'; otherwise the value of the bit is '1'.

In the bitmap encoding scheme, each row of the resulting array of bits is encoded, within a content portion, by a string of octets. If the number of bits in each row of the pel array is not a multiple of eight, then it is extended by the minimum number of '0' bits such that the last bit aligns on an octet boundary.

When the content portion is decoded, the coding attribute "number of pels per line" is used to determine the number of bits in each line that are significant, the remaining bits being ignored.

The relationship between the order of the pels and the order of the bits within an octet is such that the first pel in the order of bits is allocated to the most significant bit of an octet.

NOTE – This encoding scheme is distinct from the uncompressed mode of the CCITT Recs. T.4 and T.6 encoding schemes.

11.4 Tiled encoding scheme

Tiled content information is coded as a sequence of octet strings representing a sequence of independently coded tiles. Each tile is encoded as one octet string which may be structured or unstructured.

All the pels of a tile may be coded according to one of the following coding schemes:

- CCITT Rec. T.6 encoding scheme;
- CCITT Rec. T.4 encoding schemes;
- CCITT Rec. T.6 encoding scheme – MSB;
- CCITT Rec. T.4 encoding schemes – MSB;
- bitmap encoding scheme;
- octet run-length encoding scheme;
- packed index encoding scheme.

Alternatively the pels of a tile may be all background or all foreground, and not be coded.

11.5 Direct value encoding scheme

In this encoding the colour of each pel is directly specified in the content. The method of interleaving of the components is specified by the coding attribute “interleaving format”. The number of bits allocated for each component is specified by the coding attribute “bits per colour component”. The component values are integers. They may be scaled and offset by the colour scaling data. The scale, offset and interchange colour space are defined through the “colour spaces lists” attribute within the document profile.

The component values are integers and are interpreted as the sub-components of the “colour specification” parameter of a direct colour expression (as defined in ITU-T Rec. T.412 | ISO/IEC 8613-2). The “colour space id” and “colour tolerance” parameters of the resulting direct colour expression are derived from the corresponding parameters of the attribute “content foreground colour” applying to the object with which the raster content is associated. For this purpose, the attribute value applying is required to be a direct colour expression.

NOTE – The colour space id component will refer to the applying colour space description in the document profile which may contain colour scaling data that describe the scale and offset to be applied to the specified colour components in the raster content. Appropriate use of scaling and offsets may be required to map all colour values desired into the integer encoding space provided.

For direct value encoding, the relationship between the order of the pels and the order of the bits within an octet is such that successive pels are allocated in the order of the most significant to least significant bit.

11.6 Octet run-length encoding scheme

In this encoding scheme, an image is encoded as a sequence of runs, each run consisting of a code octet followed by one or more data octets. Each line is encoded independently. The code octet is interpreted as a binary integer in the range 0 to 255, with the most significant bit of the integer aligned to the most significant bit of the octet, and is interpreted as follows:

0<=code<=128:	the next n octets, where n is given by the code, are used to directly encode pel color components as defined in the direct value encoding scheme;
129<=code<=255:	the next octet is replicated (code – 128) times to obtain pel colour components encoded as defined in the direct value encoding scheme.

NOTES

1 The value 0 can be used as padding for alignment on multiple octet boundaries.

2 To understand how this scheme works, suppose an image employs ‘line’ or ‘plane’ as the interleaving format. Further, for this explanation, suppose the value of the parameter “bits per colour component” is equal to 8 and that during the compression of an image a point is reached where N consecutive/adjacent pels have the same value (KK) for the colour component being processed. The encoded data stream would then contain a code octet, with (in this example) the value (N+128). The next octet would contain the common colour component data value (KK in this example). For N between 2 and 128, this saves N-2 octets in the compressed data stream.

This encoding scheme is best applied in applications that use colour as an accent, for example, a blue border around a printed character text page. This encoding scheme is also most optimal when plane interleaving or line interleaving format is used. For applications that use images containing many colours and shades of colours, other encoding schemes are more appropriate.

11.7 Packed index encoding scheme

In this encoding the pel values are indices to the colour table specified in the attribute “content colour table” applying to the object with which the content is associated. This attribute is defined in ITU-T Rec. 412 | ISO 8613-2. Each index value is in the range from zero to 2**(bits-per-colour-component)-1 and occupies “bits-per-colour-component-bits”. The pel values are packed sequentially independent of the octet boundaries.

NOTE – A method of specifying colour tables in the content may be developed in a future version of this Specification.

For packed index encoding, the relationship between the order of the pels and the order of the bits within an octet is such that successive pels are allocated in the order of the most significant to least significant bit.

12 Content layout process

This clause describes a content layout process for basic logical objects associated with raster graphics content architectures.

Its purpose is to aid understanding of the semantics of the presentation attributes and coding attributes by describing the required results of such a process. However, it is not intended to specify any process that might be carried out in a particular implementation to achieve these results.

12.1 Introduction

12.1.1 Purpose

The content layout process describes the process of laying out raster graphics content into an allocated area. This area is referred to as the available area and is determined by the document layout process defined in ITU-T Rec. T.412 | ISO/IEC 8613-2.

The purpose of the content layout process is to convert content associated with basic logical components into content associated with basic layout objects.

The content layout process results in the creation of a basic layout object(s) into which the content is to be positioned. The dimensions of each basic layout object are returned to the document layout process, which determines the precise position of that basic layout object within the available area.

One of two methods can be followed for laying out the content of a basic logical object. These methods are:

- the fixed dimension content layout method;
- the scalable dimension content layout method.

The choice of method depends on the particular presentation attributes associated with the basic logical object.

12.1.2 Available area

The content layout process is constrained by the available area. The maximum dimensions that a basic layout object can take are constrained by the dimensions of the available area.

During the layout of the content associated with a basic logical object into a basic layout object, the following cases can occur:

- the formatted processable content fits into the available area;
- the formatted processable content does not fit into the dimensions of the available area. In this case, a new available area is required.

12.1.3 Presentation attributes

The content layout process takes into account the presentation attributes applying to the basic logical object with which the content is associated.

The presentation attributes applying to the content layout process may be specified in the generic layout structure and presentation styles. The values of these presentation attributes are determined according to the defaulting rules specified in ITU-T Rec. T.412 | ISO/IEC 8613-2.

12.1.4 Coding attributes

The content layout process takes into account the coding attributes applying to the content portion.

12.1.5 Raster graphics content architecture classes

The content layout process is only specified for basic logical objects associated with the formatted processable raster graphics content architecture class. The content layout process does not modify the value of the attribute “content information”.

12.1.6 Layout of the content

For the raster graphics formatted processable content architecture class, one case of laying out the content into basic objects is possible:

- *Single basic logical to single basic layout object* – The content of a single basic logical object may be laid out into a single basic layout object and is the only content associated with this basic layout object.

12.2 Notation

The abbreviations used in the description of the determination of block dimensions are defined in clause 4.

12.3 The fixed dimension content layout method

If the value of the attribute “pel spacing” is specified as other than ‘null’, the fixed dimension content layout method shall be followed.

The fixed dimension content layout method creates a block with dimensions that satisfy the values of the following attributes:

- the presentation attributes (defined in clause 8):
  - “clipping”,
  - “pel path”,
  - “pel spacing”,
  - “spacing ratio”,
- the coding attributes (defined in 9.2):
  - “number of lines”,
  - “number of pels per line”.

The fixed dimension content layout process creates a block of the minimum dimensions that are required to accommodate the clipped pel array in accordance with the pel spacing and line spacing. Note that the pel spacing is explicitly specified by the attribute “pel spacing”, whereas the line spacing is determined from the pel spacing and the attribute “spacing ratio”.

The horizontal and vertical block dimensions are determined, such that the reference areas of all the pels of the clipped pel array completely fill the basic layout object. The block dimensions depend on the pel path, pel spacing, spacing ratio, number of pels per line and number of lines as defined in Table 5.

If one of the following conditions occurs:

BDH > AAH or BDV > AAV

then the block will not fit into the available area. It is then the responsibility of the document layout process to determine whether or not the content layout process is to be repeated for an alternative available area.

Table 5 – Dimensions of basic layout object

Pel path	Horizontal block dimension (BDH in SMUs)	Vertical block dimension (BDV in SMUs)
d0, d180	NPC * PS	NLC * PS * SR
d90, d270	NLC * PS * SR	NPC * PS
NOTE – The notation used in this table is described in 12.2.		

12.4 The scalable dimension content layout method

If the value of the attribute “pel spacing” is specified as ‘null’, the scalable content layout method is followed. In this case the pel spacing will depend upon the value of the attribute “image dimensions” and the available area provided by the document layout process.

The aim of the content layout process for scalable dimension content portions is to lay out the content, within the available area, in a basic layout object with the maximum dimensions possible, considering the image dimensions and the spacing ratio specified.

The block dimensions are determined by

- the presentation attributes (defined in clause 8):
  - ‘clipping’,
  - ‘pel path’,
  - ‘image dimensions’,

  - 'spacing ratio',
- the coding attributes (defined in 9.2):
  - "number of lines",
  - "number of pels per line".

The scalable dimension content layout method first determines the aspect ratio of the clipped pel array, from the values of the attributes "number of pels per line" and "number of lines", taking into consideration the value of the attribute "spacing ratio":

$$\text{aspect ratio} = \frac{\text{NPC}}{\text{NLC} * \text{SR}} \qquad (12\text{-}1)$$

Determination of the dimensions of the basic layout object depends on the value of the presentation attribute "image dimensions". The four possible cases are illustrated in Figures 7 to 10, and are described below:

a) The attribute "image dimensions" specifies a value for the parameter "width controlled". In this case the width of the basic layout object will be within the range specified by the originator.

   The determination of basic layout dimensions is constrained by the range of allowed widths given by the value of the parameter "width controlled", the dimensions of the available area and the aspect ratio of the clipped array.

   The dimensions of the basic layout object shall be determined such that the basic layout object fits into the available area; the aspect ratio of the basic layout object is the same as that of the clipped pel array; and the width of the basic layout object has a value that is within the range of allowed widths. Also, the width of the basic layout object is determined such that the deviation from the value of the sub-parameter of "preferred width", of the parameter "width controlled", is as small as possible.

b) The presentation attribute "image dimensions" specifies a value for the parameter "height controlled". In this case the height of the basic layout object will be within the range specified by the originator.

   The determination of basic layout object dimensions is constrained by the range of allowed heights given by the value of the parameter "height controlled", the dimensions of the available area and the aspect ratio of the clipped pel array.

   The dimensions of the basic layout object shall be determined such that the basic layout object fits into the available area; the aspect ratio of the basic layout object is the same as that of the clipped pel array; and the height of the basic layout object has a value that is within the range of allowed heights. Also, the height of the basic layout object is determined such that the deviation from the value of the sub-parameter "preferred height", of the parameter "height controlled", is as small as possible.

c) The attribute "image dimensions" specifies a value for the parameter "area controlled". In this case the dimensions of the basic layout object will be within the range specified by the originator. In particular, this can be used to ensure that the basic layout object will have a fixed size.

   The determination of basic layout object dimensions is constrained by the range of allowed heights and widths given by the value of the parameter "area controlled", the dimensions of the available area and, depending upon the value of the "aspect ratio flag" of the parameter "area controlled", by the aspect ratio of the clipped pel array.

   The dimensions of the basic layout object shall be determined such that the basic layout object fits into the available area; the width of the basic layout object has a value that is within the range of allowed widths; and the height of the basic layout object has a value that is within the range of allowed heights. If the value of the attribute "aspect ratio flag" is 'fixed' there is the further constraint to the basic layout object dimensions, that the aspect ratio of the basic layout object must be the same as that of the clipped pel array. Also both the width and height of the basic layout object shall be chosen such, that their deviations from their preferred values, of the parameter 'area controlled', are both as small as possible.

d) The attribute "image dimensions" specifies a value for the parameter "automatic". In this case the dimensions of the basic layout object will be automatically adjusted to the page layout.

   The determination of basic layout object dimensions is constrained by the dimensions of the available area and the aspect ratio of the clipped pel array.

   The dimensions of the basic layout object have to be determined such that the basic layout object fits into the available area; the width of the basic layout object is given the same value as the dimension of the available area in the same direction; and the height of the basic layout object is determined such, that the aspect ratio of the basic layout object is the same as that of the clipped pel array.

If the given constraints cannot be met, then the document layout process (defined in ITU-T Rec. T.412 | ISO/IEC 8613-2) is responsible for determining if the content layout method is to be repeated for an alternative available area.

The dimensions of a basic layout object are restricted to integral multiples of 1 SMU.

13 Content imaging process

This clause describes a content imaging process for basic layout objects associated with raster graphics content architectures.

Its purpose is to aid understanding of the semantics of the shared and layout presentation attributes and coding attributes by describing the required results of such a process. However, it is not intended to specify any process that might be carried out in a particular implementation to achieve these results.

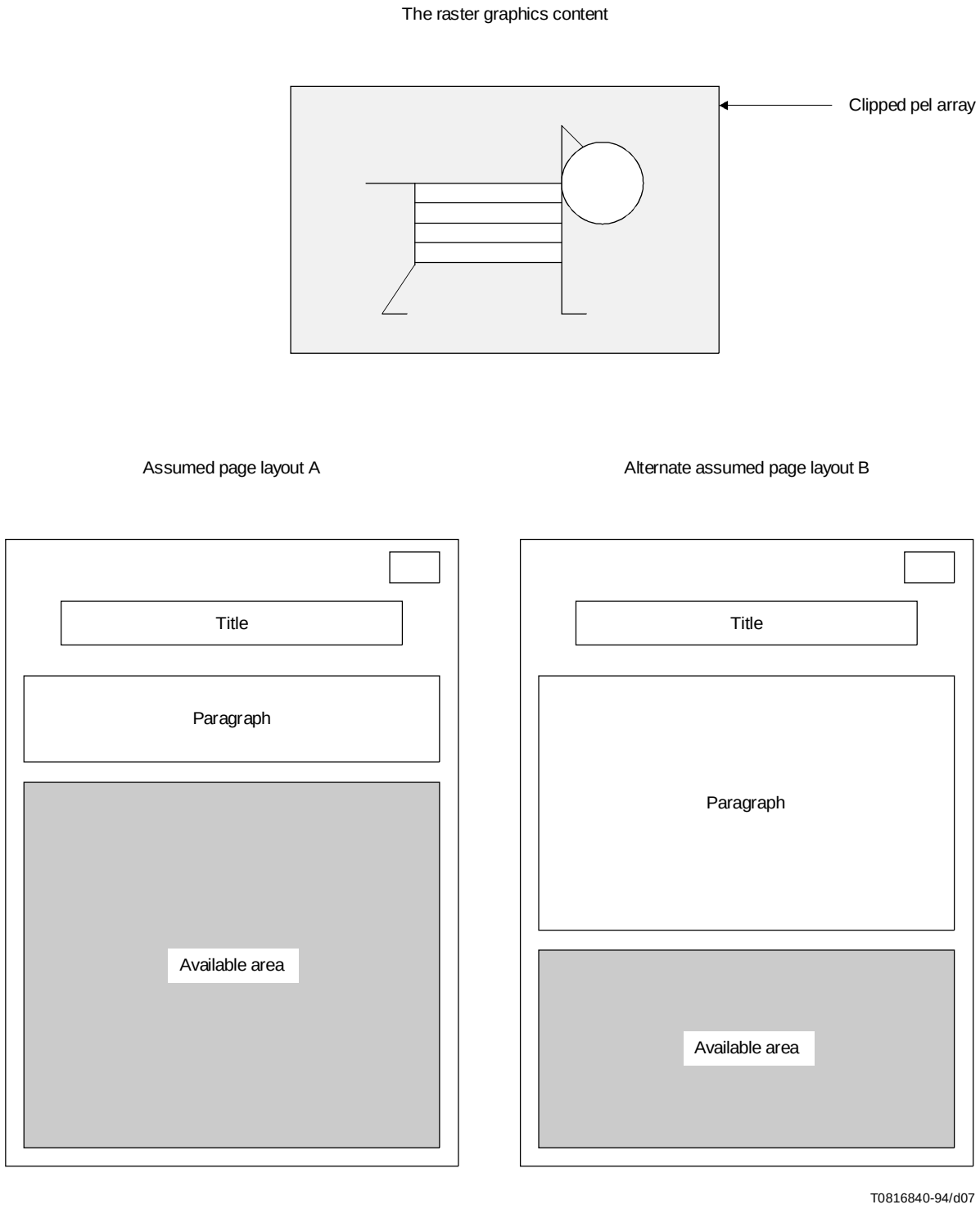
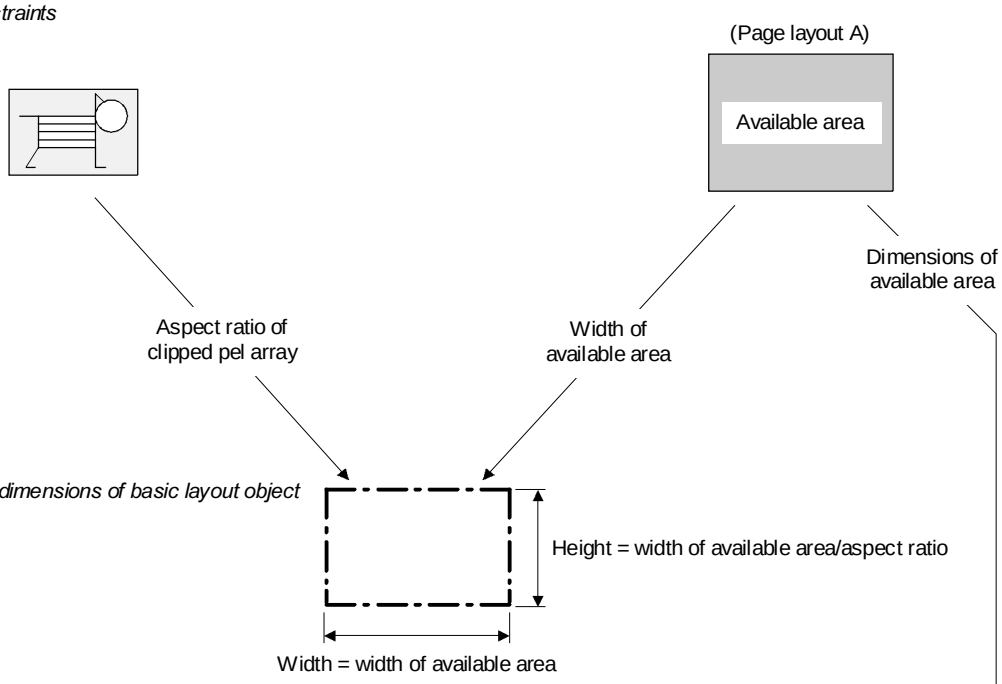


Figure 7 – Diagrams used to illustrate the process of determining the basic layout object dimensions

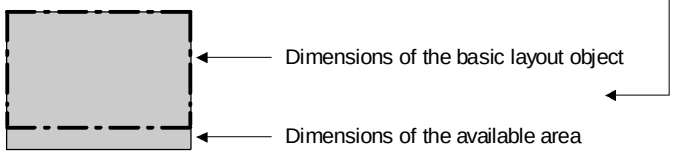
Value of presentation attribute “image dimensions”: automatic

- *Initial constraints*

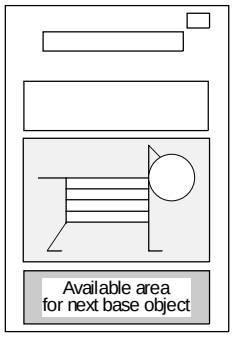


- *Allowable dimensions of basic layout object*

- *Basic layout object dimensions determined*



- *Basic objects laid out, positioned and imaged*



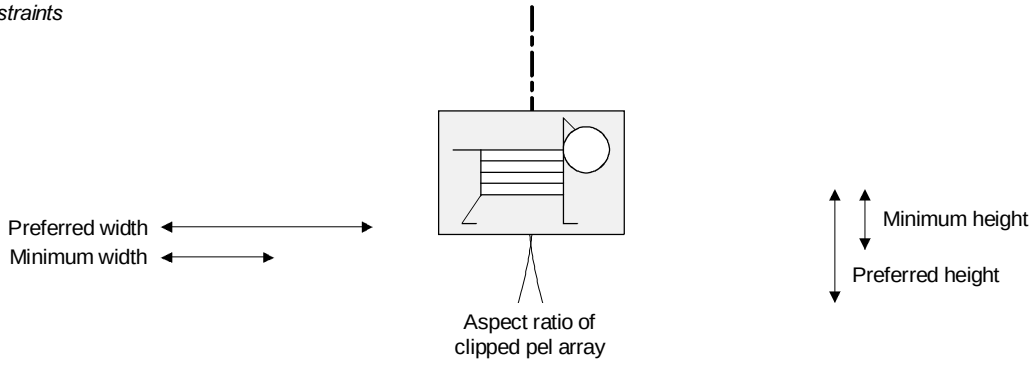
T0816860-94/d08

NOTE – In this example, the positioning of these basic layout objects assumes normal fill order, the attribute “block alignment” has value “centered” and a certain separation between two consecutive blocks.

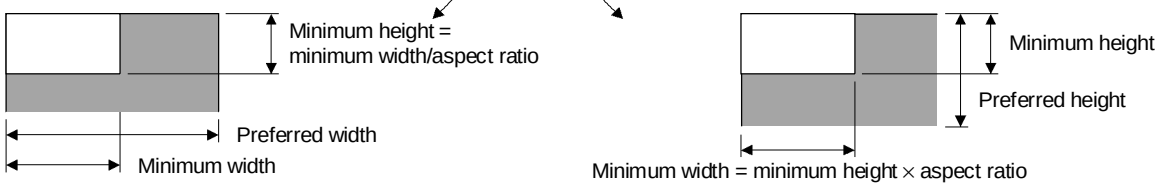
Figure 8 – Layout process for the presentation attribute “image dimensions” when a value is specified for the parameter “automatic”

Value of "image dimensions": width controlled | Value of "image dimensions": height controlled

- *Initial constraints*

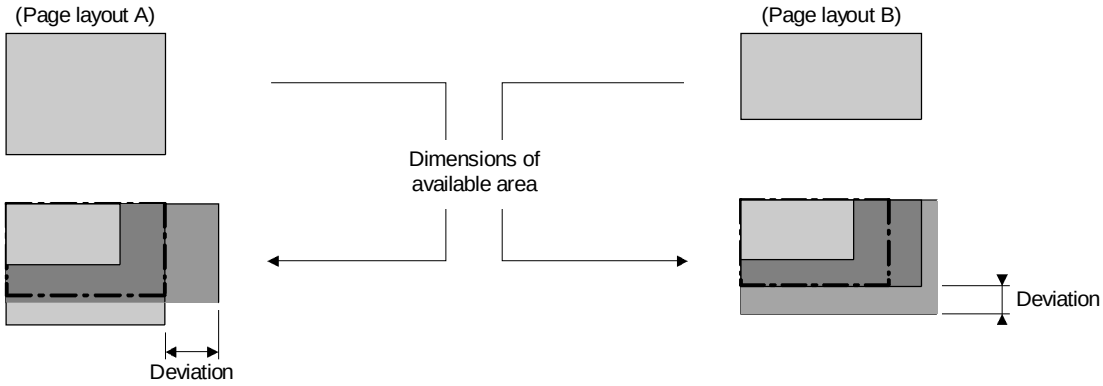


- *Allowable dimensions of basic layout object*



NOTE – The hatched areas show a range of allowable dimensions of basic layout object.

- *Basic layout object dimensions determined*



NOTES

1 The basic layout object is indicated by the dashed-dotted boundary.

2 For specifying range of allowed image widths and layout A the preferred width cannot be satisfied due to the available width.

3 For specifying range of allowed image heigths and layout B the major constraint is the height of the available area.

- *Basic objects laid out, positioned and imaged*

NOTE – In this example, the positioning of these basic layout objects assumes normal fill order, the attribute "block alignment" has value "centered" and a certain separation between two consecutive blocks.

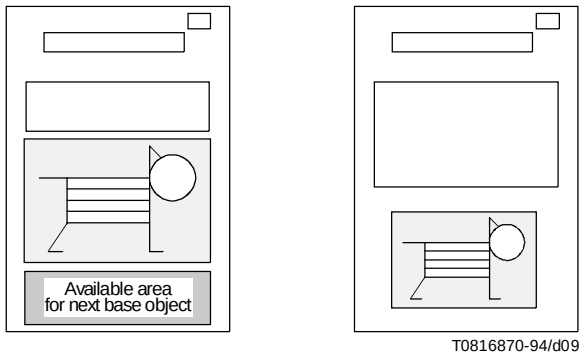
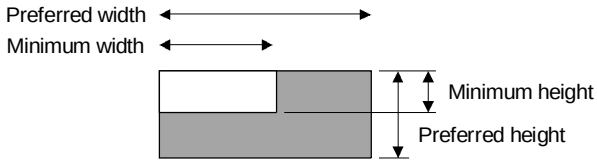


Figure 9 – Layout process for the presentation attribute "image dimensions" when a value is specified for the paramater "width controlled" or "heigth controlled"

Value of presentation attribute “image dimensions”: area controlled

- *Initial constraints*

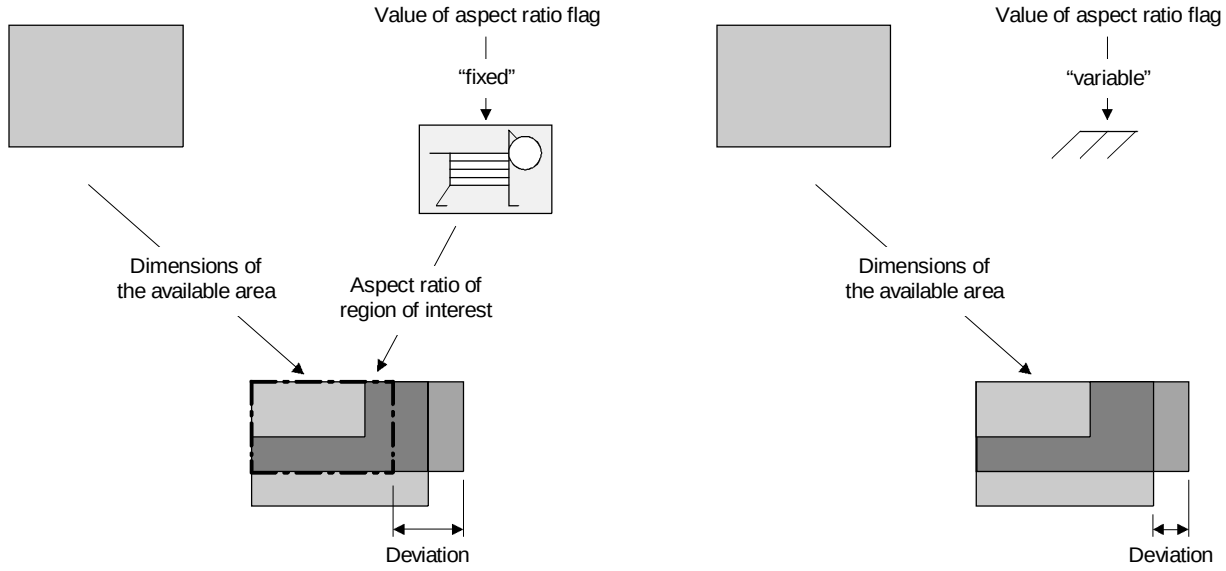


NOTE – The hatched area shows a range of allowable picture dimensions.

- *Allowable picture dimensions*

The allowable picture dimensions are completely determined by the initial constraints.

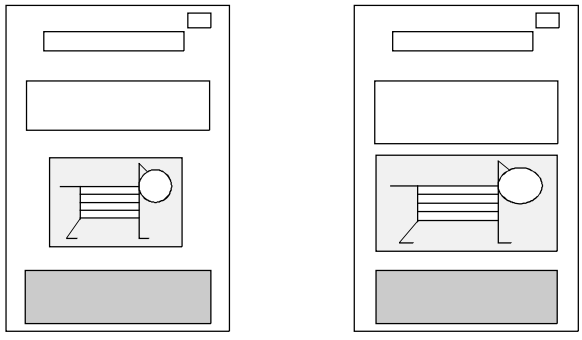
- *Basic layout dimensions determined (page layout A is used)*



NOTE – The basic layout object is indicated by the dashed-dotted boundary.

- *Basic objects positioned, laid out and imaged*

NOTE – In this example, the positioning of these basic layout objects assumes normal fill order, the attribute “block alignment” has value “centered” and a certain separation between two consecutive blocks.



T0816850-94/d10

Figure 10 – Layout process for the presentation attribute “picture dimensions” when a value is specified for the parameter “area controlled”

13.1 Introduction

The content imaging process is only concerned with the layout structures, the presentation styles and the content of basic layout components conforming to this Specification.

The content imaging process is applicable to basic layout objects associated with the formatted and formatted processable raster graphics content architecture classes.

13.2 Content imaging process for formatted form

This clause describes how the image of the content is influenced by the various presentation and coding attributes applying to the formatted raster graphics content architecture class.

The array of pels to be imaged consists only of those pels of the interchanged pel array which remain after the pels at the beginning of each line, specified by coding attribute “number of discarded pels”, have been subtracted. The first pel of this array is positioned at the initial point.

The initial point is determined by the attribute “initial offset”.

Only the pels which are positioned completely within the basic layout object are imaged.

13.3 Content imaging process for formatted processable form

This clause describes how the image of the content is influenced by the various presentation and coding attributes applying to the formatted processable raster graphics content architecture class.

The clipped pel array is imaged in the basic layout object with the first pel at the initial point.

The initial point is determined by the pel path, line progression and by the dimensions of the basic layout object, as defined in Table 2.

The pel spacing is defined as the width of the basic layout object divided by the number of pels in a line of the clipped pel array.

The line spacing is defined as the height of the basic layout object divided by the number of lines in the clipped pel array.

14 Definition of raster graphics content architecture classes

This clause defines the two classes of raster graphics content architectures described in clause 6:

- formatted raster graphics content architecture class;
- formatted processable raster graphics content architecture class.

Tables 6 and 7 specify the categories of presentation and content portion attributes that pertain to these content architecture classes. Content architecture levels for use in application profiles can be defined from these classes using the rules specified in ITU-T Rec. T.411 | ISO/IEC 8613-1.

14.1 Summary of raster graphics presentation attributes

Table 6 contains a list of raster graphics presentation attributes, and identifies, for each content architecture class, those which are defaultable and those which are not applicable.

Table 6 – Raster graphics presentation attributes

Presentation attribute	Content architecture class	
	Formatted form	Formatted processable form
Pel path	D	D
Line progression	D	D
Pel transmission density	D	---
Initial offset	D	---
Pel spacing	---	D
Spacing ratio	---	D
Clipping	---	D
Image dimensions	---	D

--- Not applicable;

D Applicable and defaultable.

14.2 Summary of raster graphic content portion attributes

Table 7 contains a list of raster graphics content portion attributes, and identifies, for each content architecture class, those which are mandatory, non-mandatory, defaultable and not applicable.

Table 7 – Raster graphics content portion attributes

Presentation attribute	Content architecture class	
	Formatted form	Formatted processable form
Number of pels per line	D	M
Type of coding	D	D
Compression	D	D[a)]
Number of discarded pels	D	---
Number of lines	---	NM
Number of pels per tile line	---	D[b)]
Number of lines per tile	---	D[b)]
Tiling offset	---	D[b)]
Bits per colour component	NM	NM
Interleaving format	NM	NM

The notation used in this table is

--- Not applicable;

M Applicable and mandatory;

D Applicable and defaultable;

NM Applicable and non-mandatory.

a) This attribute is only applicable if the value of the attribute “type of coding” is ‘T.6 encoding or ‘T.4 two-dimensional encoding’.

b) This attribute is only applicable if the value of the attribute “type of coding” is ‘tiled encoding’.

Annex A

Summary of raster graphics content architecture classes

(This annex does not form an integral part of this Recommendation | International Standard)

This annex summarizes the presentation attributes and content portion attributes that apply to each of the two content architecture classes (formatted and formatted processable) defined in clause 14, together with their permissible values and default values.

The purpose of this annex is to facilitate the definition of raster graphic content architecture levels for use in document application profiles (see ITU-T Rec. T.411 | ISO/IEC 8613-1).

A.1 Formatted raster graphics content architecture class

Content pertaining to the formatted raster graphics content architecture class may only be associated with basic layout components.

A.1.1 Presentation attributes

See Table A.1

Table A.1 – Formatted raster graphics content architecture class presentation attributes

Attribute	Permissible values	Default value
Pel path	d0, d90, d180, d270	d0
Line progression	d90, d270	d270
Pel transmission density	6, 5, 4, 3, 2, 1 BMU	6 BMU
Initial offset	(Any integer, any integer)	(Note)
NOTE – The default value of “initial offset” depends upon the pel path and line progression as defined in Table 2.		

A.1.2 Content portion attributes

See Table A.2

Table A.2 – Formatted processable raster graphics content architecture class content portion attributes

Attribute	Permissible values	Default value
Number of pels per line	Any positive integer	(Note 1)
Number of discarded pels	Any non-negative integer	(Note 2)
Type of coding	See clause 9.1.1.	Rec. T.6 encoding
Compression	‘compressed’, ‘uncompressed’ as in Rec. T.6	Compressed as in Rec. T.6
NOTES 1 The default number of pels per line depends upon the pel transmission density as defined in Table 4. 2 If the number of pels per line exceeds the image line length, the default number of discarded pels is half the excess number of pels, otherwise it is zero.		

A.2 Formatted processable raster graphics content architecture class

Content pertaining to the formatted processable raster graphics form content architecture class may be associated with basic layout or logical objects.

A.2.1 Presentation attributes

See Table A.3.

Table A.3 – Formatted processable raster graphics content architecture class presentation attributes

Attribute	Permissible values	Default value
Pel path	d0, d90, d180, d270	d90
Line progression	d90, d270	d270
Pel spacing	(Any positive integer, any positive integer) SMU, 'null'	(4,1) SMU
Spacing ratio	(Any positive integer, any positive integer)	(1,1)
Clipping		(Note 1)
First coordinate pair	(Any non-negative integer, any non-negative integer)	
Second coordinate pair	(Any non-negative integer, any non-negative integer)	
Image dimensions	(Note 2)	Automatic
Width controlled		
Minimum width	Any non-negative integer	
Preferred width	Any non-negative integer	
Height controlled		
Minimum height	Any non-negative integer	
Preferred height	Any non-negative integer	
Area controlled		
Minimum height	Any non-negative integer	
Preferred height	Any non-negative integer	
Minimum width	Any non-negative integer	
Preferred width	Any non-negative integer	
Aspect ratio flag	'Variable', 'fixed'	
Automatic	'null'	

NOTES

1 The default value of "clipping" is the first coordinate pair in the content portion (0,0) and the last coordinate pair (N-1, L-1), where N is number of pels per line and L is number of lines.

2 Minimum values must not be greater than preferred values.

A.2.2 Content portion attributes

See Table A.4.

Table A.4 – Formatted processable raster graphics content architecture class content portion attributes

Attribute	Permissible values	Default value
Number of pels per line	Any positive integer	None
Number of lines	Any positive integer	None
Type of coding	Bitmap encoding Rec. T.4 encoding (one-dim.) Rec. T.4 encoding (two-dim.) Rec. T.6 encoding Rec. T.4 encoding (two-dim.) – MSB Rec. T.6 encoding – MSB Tiled Direct value Octet run-length Packed index	Rec. T.6 encoding
Compression	‘compressed’ ‘uncompressed’ as in Rec. T.6	‘compressed’ as in Rec. T.6 (Note)
Number of pels per tile line	Any positive integer	512
Number of lines per tile	Any positive integer	512
Tiling offset	(Any non-negative integer, less than “number of pels per tile line”, Any non-negative integer less than “number of lines per tile”)	(0,0)
Tile types	Sequence of positive integers	Rec. T.6 encoded
Bits per colour component	A positive integer or a sequence of non-negative integers	1
Interleaving format	‘pel’, ‘line’, ‘plane’	‘plane’
NOTE – The attribute “compression” is only applicable if the value of the attribute “type of coding” is ‘Rec. T.6 encoding’, ‘Rec. T.4 two dimensional encoding’, ‘Rec. T.6 encoding – MSB’, ‘Rec. T.4 two dimensional encoding – MSB’, or ‘tiled encoding’.		

Annex B
Summary of ASN.1 object identifiers

(This annex does not form an integral part of this Recommendation | International Standard)

Values of ASN.1 object identifiers are assigned in various clauses of this Specification. These assignments are summarised in Table B.1.

Table B.1 – Summary of ASN.1 object identifiers

ASN.1 object identifier value	Description	Subclause
{ 2 8 1 7 2 }	Raster-Gr-Presentation-Attributes	10.2
{ 2 8 1 7 3 }	Raster-Gr-Coding-Attributes	10.3
{ 2 8 1 7 4 }	Raster-Gr-Profile-Attributes	10.4
{ 2 8 2 7 0 }	Formatted raster graphics content architecture class	8.4.1
{ 2 8 2 7 2 }	Formatted processable raster graphics content architecture class	8.4.1
{ 2 8 3 7 0 }	Identifies ‘Rec. T.6 encoding’	9.1.1
{ 2 8 3 7 1 }	Identifies ‘Rec. T.4 one-dimensional encoding’	9.1.1
{ 2 8 3 7 2 }	Identifies ‘Rec. T.4 two-dimensional encoding’	9.1.1
{ 2 8 3 7 3 }	Identifies ‘bitmap encoding’	9.1.1
{ 2 8 3 7 5 }	Identifies ‘tiled encoding’	9.1.1
{ 2 8 3 7 6 }	Identifies ‘Rec. T.6 encoding – MSB’	9.1.1
{ 2 8 3 7 7 }	Identifies ‘Rec. T.4 one-dimensional encoding – MSB’	9.1.1
{ 2 8 3 7 8 }	Identifies ‘Rec. T.4 two-dimensional encoding – MSB’	9.1.1
{ 2 8 3 7 9 }	Identifies ‘direct value encoding’	9.1.1
{ 2 8 3 7 10 }	Identifies ‘octet run-length encoding’	9.1.1
{ 2 8 3 7 11 }	Identifies ‘packed index encoding’	9.1.1

Annex C

SGML representation of raster graphics content-specific attributes for ODL

(This annex forms an integral part of ISO/IEC 8613-7 only)

NOTE – To maintain correspondence in clause numbering within the body of this Specification, this portion describing the use of Open Document Language (ODL) is specified in a normative annex rather than in the body of this Specification.

C.1 Introduction

This annex specifies a standardised SGML representation of attributes related to raster graphics content architectures, for use with the Open Document Language (ODL) defined in ISO/IEC 8613-5. ODL is an SGML application conforming to ISO 8879.

The definitions of ISO 8879 apply to this annex.

C.2 Names and public identifiers

The following notation declarations include the public identifiers of the data content notations for the content architecture classes defined in this Specification. The ODL content architecture class names follow the prefix ‘ODA’ in the notation names.

<!NOTATION ODArfp PUBLIC “ISO/IEC 8613-7:1994//NOTATION

Raster graphics formatted content architecture//EN”>

<!NOTATION ODArfp PUBLIC “ISO/IEC 8613-7:1994//NOTATION

Raster graphics formatted processable content architecture//EN”>

C.3 Representation of attribute values

Attribute values are represented in a clear text encoding, using the rules defined in this annex.

NOTE 1 – The content portions themselves are encoded according to the body of this Specification.

The representations of the ODA attributes are presented in the form of SGML public text. In this form they can be referenced from a document, rather than be included within it.

The semantics of the attribute values are specified in the body of this Specification. The representation of attribute values is as specified in the body of this Specification, except where a different representation is specified in the public text or elsewhere in this annex.

The default values specified in the public text are those defined in the body of this Specification. If a different default value is wanted for an element (such as a non-standard default value specified in the document profile or in an object class description), the public text should not be referenced; instead, the definitions should be duplicated with the required changes made in the default values.

Attribute values are sequences of one or more parameters, separated by SGML separator characters. An omitted parameter is represented by the keyword: 00

A parameter is one of a number of primitive types: string, keyword, or integer. String parameters are delimited, and may contain separator characters. Other parameters are not delimited, and may not contain separator characters.

NOTE 2 – Most attribute values consist of a single parameter.

C.3.1 Constructed parameters

No constructed parameters are defined in this Specification.

C.3.2 String parameters

A string parameter could contain characters not permitted in an SGML name token, and is therefore delimited by SGML LIT or LITA delimiters.

C.3.3 Keyword parameters

Possible keyword values are defined by the body of this part for some parameters, and by this annex for others.

Lower-case letters in keyword parameters are treated as though they were upper-case.

For certain parameters whose permissible values constitute a set of keywords, fixed numeric values, or both keywords and fixed numeric values, the value is chosen by choosing from a set of substitute keywords. These parameters are documented in comments in the public text, in the form:

parameter name: keyword ..

with the keywords appearing in the same order as the permissible values that they represent appear within the body of this Specification. For attributes that have only one parameter, the attribute name is the parameter name.

NOTE – For example:

-- line progression: d90 d270 -

means that a value of 'd90' represents 'd90' and a value of 'd270' represents 'd270'.

C.3.4 Integer parameters

An integer is represented by a sequence of digits. If preceded by a hyphen, it represents a negative integer; otherwise, a positive integer.

C.4 Presentation attributes

C.4.1 Shared presentation attributes (format attribute-directives)

```
<! -- © International Organization for Standardization 1994
     Permission to copy in any form is granted for use with conforming SGML systems and  applications as defined in ISO 8879, provided this notice is included in all copies.
⇒
<! -- Public text entity. Typical invocation:
<!ENTITY % r-p-ad     PUBLIC "ISO/IEC 8613-7:1994//TEXT
                      Raster Presentation Format Attribute-Directives//EN">
<!ATTLIST   (rf|rfp) %r-p-a; \%r-p-ad; >
⇒
            rclip     NUMBERS     #IMPLIED    -- clipping --
            rlinepro  NUMBER      d270        -- line progression: d90 d270 --
            rpelpath  NUMBER      d0          -- pel path: d0 d90 d180 d270 --,
```

C.4.2 Layout presentation attributes (formal attributes)

```
<!-- © International Organization for Standardization 1994
     Permission to copy in any form is granted for use with conforming SGML  systems and applications as defined in ISO 8879, provided this notice is included in all copies.
⇒
<! -- Public text entity. Typical invocation:
<!ENTITY    \% r-p-a  PUBLIC "ISO/IEC 8613-7:1994//TEXT
                      Raster Presentation Format Attributes//EN">
<!ATTLIST   (rf|rfp) \%r-p-a; \%r-p-ad; >
⇒
            rinitoff  NMTOKENS    #IMPLIED    -- initial offset --
            rpeldens  NUMBER      6           -- pel transmission density --
```

C.4.3 Logical presentation attributes (format directives)

```
<! -- © International Organization for Standardization 1994.
     Permission to copy in any form is granted for use with conforming SGML systems and  applications as defined in ISO 8879, provided this notice is included in all copies.
⇒
<! -- Public text entity. Typical invocation:
<!ENTITY    \% r-p-d  PUBLIC "ISO/IEC 8613-7:1994//TEXT
            Raster Presentation Format Directives//EN">
<!ATTLIST   rfp \%r-p-d; >
⇒
            rdim      NAME        auto        -- image dimensions: width height area auto --
            rdimsub   NMTOKENS    ,#IMPLIED   -- image dimensions sub-parameters --
```

```
        rpelspc   NUMBERS      “4 1”          -- pel spacing: ‘0’ means ‘null’ --
        rspacing  NUMBERS      “1 1”          -- spacing ratio --
```

C.5 Coding attributes

⇒

```
<! -- Public text entity. Typical invocation:

<!ENTITY     \% r-p-c PUBLIC “ISO/IEC 8613-7:1994//TEXT

             Raster Coding Attributes//EN”>

<!ATTLIST NOTATION (ODArf|ODArfp) \%r-p-c; >

⇒       codetype    NAME      T.6          -- type of coding: T.6 T.4-1 T.4-2 BITMAP
                                           DIRECT RUNLEN INDEX --
        rcomp       NAME      compress     -- compression: COMPRESS UNCOMP --
        rintlv      NAME      plane        --interleaving format: PEL LINE PLANE--
        rlines      NUMBER                 #IMPLIED      -- number of lines --
        rppl        NUMBER                 #REQUIRED     -- number of pels per line --
        rdiscard    NUMBER                 #IMPLIED      -- number of discarded pels --
        bitscomp    NUMBERS                1             -- bits per colour component --
```

Index

NOTE – The number(s) associated with the index entry indicates the page(s) where the index entry can be found.