Digital Data Exchange Specifications (DDES)

and ANSI's Image Technology Committee (IT8)
A Status Report

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Abstract:

The graphic arts industry's efforts in developing digital data exchange specifications (DDES) for the exchange of digital data between electronic prepress systems and respective peripherals continues; now in accordance with standards making procedures as set forth by the American National Standards Institute (ANSI).   The National Printing Equipment and Supply Association (NPES) is the secretariat for the newly formed Image Technology Committee (IT8) which is chaired by Frank Benham, Vice-President, American Color Corp.

Under this committee two subcommittees have been formed: The User Technical Subcommittee (UTS), chaired by Jack Lane, President, Potomac Graphic Industries, Inc.; and The Vendor Technical Subcommittee (VTS), chaired by S. Thomas Dunn, President, DTI.   This structure provides for the necessary dialogue required to develop a truly functional exchange specification for the graphic arts industry.

Two working groups currently exist under the VTS, the Color & Line Art Task Force and the Geometric Art Task Force.

This paper presents an examination of the ongoing technical activities being carried out by these groups.

Background

In 1985 dialogue began on the perceived need to develop digital data standards for the exchange of data between color electronic prepress systems™(CEPS™) and their respective peripherals. This dialogue was formalized through a technical presentation at the 1985 TAGA Conference[1] and a user/vendor forum on the subject held in conjunction with the 1985 *Lasers in Graphics/Electronic Publishing in the 80's Conference.*[2]

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In December of 1985 a technical committee was formed to address the issues involved with developing digital data exchange specifications (DDES™) for the graphic arts industry.

By May of 1986 this group had reached consensus on, and released, it's first draft of the User Exchange Format (UEF™).[3] The UEF is a standardized format that allows for the exchange of color picture data between CEPS manufactured by a variety of different vendors.

Technical representations from 3M, Crosfield Electronics, Dainippon Screen Mfg. Co., Eikonix-A Kodak Co., Dr.-Ing. Rudolf Hell, and Scitex, assisted with the development of the UEF specification.

In conjunction with the development of the UEF the technical committee investigated the possibility of using other developing standards to assist in its own development work on behalf of the graphic arts industry. In doing so it has given a thorough examination to the Graphical Kernal System (GKS), the Computer Graphics Interface (CGI), the Computer Graphics Metafile (CGM), and the Programmer's Hierarchical Interactive Graphics Standard (PHIGS), under development in the computer graphics/office systems industry; the ACR/NEMA specification drafted for the medical imaging industry; the Initial Graphics Exchange Specification (IGES) under development in the CAD/CAM market; and the ongoing developmental work being carried out by the International Telegraph and Telephone Consultative Committee (CCITT) in the area of terminal equipment and protocols for telematic services.

In parallel to the technical work being carried out by this committee the group took steps to formalize its organization in accordance with the rules and procedures set forth by the American National Standards Institute (ANSI). The National Printing Equipment and Supply Association (NPES), at the request of its members and under approval of its board of directors, made the commitment to undertake the significant and important task of providing secretariat services to the continued development of DDES. NPES accepted this role in May of 1986.

Just prior to the NPES's stepping forward to accept this responsibility of acting as secretariat to the DDES activity, an open forum was held by ANSI to determine whether or not there was sufficient interest in formulating ANSI standards in the graphic arts industry. This meeting, chaired by Roland Zavada, chairman of the American National Standards Institute Image Technology Standards Board (ITSB), was held immediately after the April 1986 annual meeting of the

Technical Association of the Graphic Arts (TAGA)[4] in Valley Forge. Due in part to the interest that was apparent at this meeting, and to NPES's subsequent acceptance of the secretariat position, the Image Technology committee number eight (IT8) was designated by ANSI as the ongoing designation for the DDES activities.

Organizational Structure of IT8

The IT8 Committee is chaired by Frank Benham, Vice President, American Color Corporation. Members of the IT8 Committee include representatives from a variety of graphic arts industry technical and trade associations including: the Gravure Association of America, the Technical Association of the Graphic Arts (TAGA), the Research & Engineering Council of the Graphic Arts Industry (R&E Council), the American Newspaper Publishers Association (ANPA), the Flexographic Technical Association, the Graphic Communications Association (GCA), the Graphic Prepartory Association (GPA), the International Prepress Association (IPA), the National Association of Printers and Lithographers (NAPL), the National Printing Equipment and Supply Association (NPES), the Graphic Arts Technical Foundation (GATF), the Screen Printing Association, and the National Association of Diemakers and Diecutters (NADD).

Participation at the full committee level of IT8 is open to any individual or organization that can demonstrate that it will be effected by the work being carried out by the IT8 Committee. There are no fees for membership at the full committee level. Further, the ANSI procedures for the development of American National Standards have been adopted by this group.

There are two technical subcommittees operating under the IT8 Committee: the User Technical Subcommittee (UTS) and the Vendor Technical Subcommittee (VTS). The former is chaired by Jack Lane, President, Potomac Graphic Industries, Inc., the latter by Dr. S. Thomas Dunn, President, Dunn Technology, Inc. Thus far the two groups have met both independent of each other as well as in conjunction with each other. Though important dialogue that contributes to furthering the developmental work of DDES is ongoing.

Much of the technical work involved with preparing a draft proposed specification, as well as reviewing the developing draft standards being issued by other industries, is carried out at the task force level. There are currently two ongoing task forces under the VTS. These are the Color Picture/Line Art Task Force, chaired by Kennard Cloud; and the Geometric Art Task Force, chaired by Arve Jensen,

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Chemco Systems. A study group has been formed to investigate the current feasibility of establishing an additional task force that would address the issues involved with developing Device Exchange Formats (DEF). This study group is chaired by Bob Strum of DuPont.

Organizational Structure of the VTS Work

The DDES activity began by addressing color pictures on magnetic tape, as a path of convenience. This has since expanded to cover line art and geometric art. The current directions of the IT8 group are to finish building a foundation of standards for the data bases:

- Pictures
- Line Art
- Geometric Art

As these are being developed, transfer media, other than magnetic tape are under consideration.

The geometric art task force is looking at a variety of media for transfer of this data. The Device Exchange Format study group is also addressing a variety of potential interfaces.

The current strategy of the IT8 group is to build standards for the underlying data bases, to allow their individual transfer. Beyond this it is planned to move into the ever increasing difficult areas of transferring completed pages in various states to allow various levels of further editing, after transfer.

The issues of editability after transfer are not simple, and will require much further work.

A structure to the IT8 standards activity has been made. This structure has not been approved by any of the IT8 committees, but is presented here for reference on the developing activities.

Proposed Structure IT8

I. Introduction

This document does not deal with specific definitions. It deals with the structural content of the nomenclature for the developing standards under DDES that are hoped to become ANSI IT8 approved standards. This is a proposed structure under consideration by the VTS.

(All references to fields in headers, and bytes are to the UEF00 specification for pictures.)[5]

II. DDES Structure

The proposed overall structure is given in the following diagram.
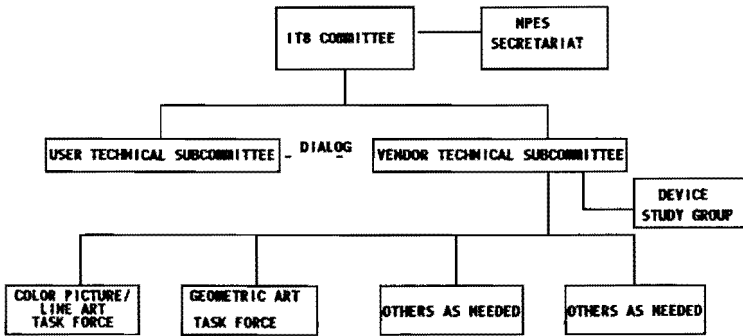
This structure has four basic levels.

Level 1: The specific specification dealing with components of the digital data base to be transferred.

Level 2: A group of Level 1 specifications with a common application (i.e., magnetic tape transfer, class XX device transfers, etc.).

Level 3: A group of Level 2 specifications forming the body of DDES, or electronic prepress exchange specifications.

Level 4: The ANSI versions of Level 1, 2 and 3 specifications.

Note: Application is used in the broadest sense: (i.e.: means of transfer, intended use of data, etc.).

A. Level 1

Level 1 specifications cover specific areas of digital data that have common requirements for data formats and interpretation of these formats. Currently at Level 1, there exist three specific groups of this nature:

UEF00: Color Picture Data
UEF01: Line Art Data
UEF02: Geometric Data

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These are, for magnetic tape application, written as UEFьXX in UHL1, bytes 04-08.

Byte 08 is used to indicate the type of data represented by the Level 1 field.   This can be 0-9, a-z.

Byte 07 is used to indicate the revision level of the specific Level 1 specification.   This can be 0-9, a-z.

Within a group of Level 2 specifications, all Level 1 specifications of the same revision number will have, wherever appropriate, the same data formats and interpretations of these formats.

Across Level 2 specifications, the type of data (byte 08) designation will, wherever practical, have the same meaning.

Nothing in this structure prevents the further division of a Level 1 specification into multiple similar groups of data.   An example is the potential use of UEF01 to cover color and monotone line art. Equally, nothing in this structure prevents color line art and monotone line art from having a different byte 08 (UHL1).

For each group of Level 2 specifications, bytes 04-06 (UHL1) will have a common and unique alpha entry for all Level 1 specifications within this Level 2 group.

B.   Level 2

Level 2 specifications are groups of Level 1 specifications with a common application or transmission requirement. Currently at Level 2 there exists DDES00 for the magnetic tape transfer of data.   This is written as "DDES" in bytes 43-46 in VOL1 and "00" in bytes 49-50 in VOL1.

Currently, DDES00 is a group of Level 1 specifications denoted by UEF00, UEF01, and UEF02.

It is possible that the next group of Level 1 specifications forming a Level 2 specification is "device exchange formats (DEF)".

Byte 50 is used to indicate the applications group represented by this Level 2 field.   This can be 0-9, a-z.

Byte 49 is used to indicate the revision level of the specific Level

2 application. This can be 0-9, a-z.

All Level 1 specifications in use with a Level 2 specification must carry the same revision code.

Level 2 specifications, as they develop will carry the common information of the Level 1 specifications. For instance, in the case of DDES00, the General Tape Format through HDR2 would be in DDES00 since they are identical at the UEF level (Level 1).

It is also possible that Level 2 specifications will be used to tie together the Level 1 specifications for specific applications. For example, in the case of DDES00, UEF02 could cover both geometric described images as well as geometrically described image assembly data or UEF02 could cover geometric images and DDES00 could cover geometric assembly of images.

Note: In the traditional seven layer protocol, several layers will probably exist at DDES Level 2.

C. Level 3

This is the activity for DDES and is the ANSI IT8 activity (when approved). No specifications will be developed at Level 3, this level will be used to coordinate the interface with ANSI and provide overview explanations and documents for the DDES body of specifications.

D. Level 4

This is the ANSI results of the DDES specifications.

Although this structure does not follow the seven level guideline, it will follow the seven layer guideline in the following manner, through the relation of Level 2 specifications to the layer.

LAYER	DDES LEVEL 2 Specifications
7	
6	XX
5	
4	
3	
2	YY
1	

Given the current status of DDES development, it is the intention of the IT8 Vendor Technical Subcommittee to modify and adapt this structure as a superset of the basic structure defined herein.

UEF — Status

Work on the User Exchange Format (UEF) is currently carried out under the Color Picture/Line Art Task Force. Subsequent to the initial release of DDES00-UEF, this task force drafted an alpha test plan under which preliminary testing of the UEF would take place amongst the participating vendors. To date two of the participating vendors have successfully exchanged data via magnetic tape under this test plan.

In addition, several vendors not as of yet affiliated with the IT8 Committee have received copies of the DDES00-UEF draft specification and have written tapes which can be read under the UEF.

After the Color Picture/Line Art Task Force has completed its alpha testing, it will move to beta testing which will take place at user sites.

In addition, the Color Picture/Line Art Task Force is currently developing a draft specification for the exchange of line art data.

Line Art Developments

The picture/Line Art Task Force of VTS is currently reviewing a draft proposal for the format of line art.

This draft proposal includes two forms of simple run length coded data to represent line art. One deals with multiple flat colors of line art across an image, and the other deals with black and white line art.

Proposed Line Art Format

The following is the PROPOSED line art formats. Note: These have not been approved by any IT8 committee and currently the subject of a ballot by the VTS. First the color line art proposal is described and then the monotone line art. Both are described with respect to the nomenclature used for the UEF00 picture standard.

I.   Colored Line Art

A. Color Table

The color table establishes the connection between the color numbers in the data entries and the actual color values of those numbers. The table is the first data block on the tape following the optional vendor data blocks, and is one 8192 byte block (UEF block size) in physical size. This table is only used for colored line art files (file type "0001" in UHL2, and data type "30" in UHL3) and is not required for monotone line art files (data type "20").

The table consists of 256 eighteen byte entries. The first byte is reserved and is always padded with "0". The second byte is the color number, and may be a value from "0" to "255" in binary representation. Bytes 02-05 contain the color values for YMCK or CMYK for UEF and the values noted in section III.6.2 for EUEF. All color values and entry notation is established by the parameters in UHL3. Bytes 06-17 are for EUEF use only. The first entry in the table (color number "0") is reserved for vendor use and is a non-printable color for the purposes of data transfer. All entries must be in order, and in the proper position in the table (for example, color number "5" must be the sixth entry in the table), but not all entries need to be present. If a color number is not used, the table entry (bytes 01-17) should be padded with blanks.

Figure 1 specifies block name, length of bytes, contents, UEF01 value, and byte number for the Color Table.

FIGURE 1

Byte 00	Byte 01	Bytes 02-05	Bytes 06-17
"0"	"0"	reserved	
"0"	"1"		
"0"	"2"	CMYK	Optional
"0"	"3"	or	EUEF
"0"	"4"	YMCK	per
.	.	color	section
.	.	values	6.2
.	.	per	
"0"	"255"	UHL3	

2. Colored Line Art Coding Scheme

Value "30" in bytes 04-05 of UHL3 signifies the format for colored line art data. Color line art data is two bytes long, with the first

byte a binary number representing a color number in the Color Table, and the second byte a binary number representing the run length of that color (from "0" to "255").

In all line art data forms, a line is always terminated by the two byte entry "00".

If the run length of the data entries does not equal the number of pixels established by the values in UHL3 for line length and resolution, then the line should be padded with the last value received. For example, if the last color line art entry was |"5"|"255"| then the color represented by color number "5" should continue to the end of the line. If the line is to be preceded with or ended with a transparent value, then color number "0" should be used for the appropriate length, signifying a non-printable color. If the number of lines in the image does not equal the number of lines specified in UHL3, then the remaining lines are assumed to be the last color in the last line.

II.   Monotone Line Art Coding Scheme

Monotone line art data is run length encoded with a two part entry. The first part signifies the color of the run (black/white), and the second the length of the run for this value. Two data entry formats are used, specified in bytes 04-05 in UHL3.

Value "20" signifies monotone (or binary) line art, and has two forms, a short form and a long form. Each entry is 16 bits long in binary notation with the high order bit (bit 15) denoting the form ("0" = short, "1" = long"). The short form is:

```
(bit)    15   14         7 6           O
         ------------------------------
short    |"O"| white rl   | black rl  |
         ------------------------------
```

where "0" signifies short form, "white rl" signifies the length of run in binary for white (from "0" to "255") and "black rl" signifies the length of run in binary for black (from "0" to "127"). The long form is:

```
(bit)    15   14   13                 O
         ------------------------------
long     |"1"|  B  | length           |
         ------------------------------
```

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where "1" signifies long form, "B" the image value with "0" = white and "1" = black, and "length" = the length of run in binary (from "0" to "16383").

In all line art data forms, a line is always terminated by the two byte entry "00".

If the run length of the data entries does not equal the number of pixels established by the values in UHL3 for line length and resolution, then the line should be padded with the last value received. For example, if the last monotone line art entry was |"0"|"24"| "255"| then black should continue to the end of the line. If the number of lines in the image does not equal the number of lines specified in UHL3, then the remaining lines are assumed to be white. In the case of monotone coded files, there is no mechanism for transparent entries.

III. Color Sequence

The sequence of colors for colored line art (data type "30") is "YMCK" or "CMYK" defined by appropriate letters in bytes 08-11 and bytes 06 and 07 are "04". In UEF bytes 12-23 are always blank. For monotone line art (data type "20") bytes 06-31 are always blank.

Geometric Art Developments

The Geometric Art Task Force is addressing a variety of issues concerning the standardization of the vector and mathematical description components of images and of composed pages. One particular area of consideration for this group is the interface between the CAD stripping system and the color electronic prepress system (CEPS).

The Geometric Art Task Force has selected the Initial Graphics Exchange Specification (IGES) as a strawman format for developing the structure of the geometric data to be transferred. In selecting IGES as a strawman format, the group is **NOT** saying that their resulting specifications and standards will be compatible with IGES. There may or may not result a general level of compatibility with IGES. Rather, the group wishes to take advantage of the excellent work of IGES in developing its own graphic arts approach to the geometric data required for transfer.

This VTS task force has selected a set of required primatives and their attributes and will be presenting them to the UTS in the near future.

Conclusion

From the foregoing it should be clear that a significant portion of the electronic prepress, printing and publishing industry has made tremendous strides towards the goal of standardizing digital data formats to enable its transportability across various systems and our industry's various existing segments.

In 1985, when discussions on this subject first began, we set as our goal the achievement of digital data becoming as transportable throughout our industry as film currently is. Despite the fact that we admittedly still have a ways to go in the achievement of this goal, we feel that definite, significant progress has been made in this direction.

Monotone and Color

As the group develops, it continues to be primarily driven by CEPS vendors. At this time, it is appropriate for the IT8 group to broaden its base to include MEPS vendors. NPES and VTS are soliciting these vendors for membership. The influence of the MEPS vendors is extremely important to the broad and general application of the resulting standards.

For instance, newspaper display ad systems contain a very high level of geometric art. MEPS deals extensively with line art, and the color picture specification should have a subset for monotone pictures.

Both monotone vendors and users are requested to join their respective technical subcommittees. Membership information is available from Kip Smythe, NPES, 6849 Old Dominion Drive, Suite 200, McLean, VA 22101, (703) 734-8285.

Footnotes

1. *The Issue of Standards for Electronic Prepress*, Patrice M. Wagner & S. Thomas Dunn, Dunn Technology, Inc. (DTI), **1985 TAGA Conference Proceedings**, pp. 88-95.

2. *Digital Data Exchange*, Bernstein, E.; Cloud, K.; Chrusciel, E.; Dannenberg, R.; Dunn, S.T.; Hitchman, J.; et. al., **1985 Lasers in Graphics/Electronic Publishing in the 80's Conference Proceedings**, Vol. I, pp. 32-75/5.

3. *DDES-Digital Data Exchange Specification, DDES00 Approved -The User Exchange Format (UEF)*, **The Dunn Report on Electronic Publishing & Prepress Systems**, Vol. IV, No. 6, June 1986, pp. 1-16.

4. *A National Standards Coordinating Committee for the Graphic Arts Technologies*, Roland J. Zavada, **1986 TAGA Conference Proceedings**, pp. 304-313.

5. *DDES-Digital Data Exchange Specification, DDES00 Approved -The User Exchange Format (UEF)*, **The Dunn Report on Electronic Publishing & Prepress Systems**, Vol. IV, No. 6, June 1986, pp. 1-16.