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Draft for Development

The structure and representation of data for interchange at the application level (DIAL)

Part 1. Recommendations for syntax and basic principles

Projet à développer

La structure et représentation des informations destinées à l'échange au niveau
d'application (DIAL)

Partie 1. Recommandations concernant la syntaxe et les principes de base

Entwurf zur weiteren Ausarbeitung

Struktur und Darstellung von Daten für den Austausch auf dem Anwendungspegel (DIAL)

Teil 1. Empfehlungen für Syntax und Grundsätze

DD 75 : Part 1 : 1981

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This publication is not to be regarded as a British Standard.

It is issued in the Draft for Development series of publications and is of a provisional nature because, although DIAL follows well established approaches that have been used in the fields of defence and international trade procedures, it involves the development of new detail and the combination of established details which have not been previously used in conjunction.

It is recommended that this publication should be applied on this provisional basis so that information and experience of its practical application may be obtained.

A review of this Draft for Development will be carried out not later than two years after its publication. Notification of the start of the review period together with a request for the submission of comments from the users of this

Draft for Development will be made in an announcement in the appropriate issue of BSI News. Observations which it is felt should receive attention before the official call for comments will be welcomed.

The British Standards Institution requests that, because of the provisional nature of the publication, its reference number should not be marked on products.

Foreword

This Draft for Development has been prepared under the direction of the Data Processing Standards Committee.

The draft is being published in two Parts, the other Part being:

Part 2. Recommendations for the basic directory of data elements and groups

Draft for Development

The structure and representation of data for interchange at the application level (DIAL)

Part 1. Recommendations for syntax and basic principles

0. Introduction

0.1 Under present conditions, computer-produced output on paper is often used as source material for keying for input into another system. In terms of direct cost this may be uneconomic; the indirect costs due to delay and error may be even greater. Yet such inefficient methods are widely used.

0.2 Interchange of data in machine-readable form with little or no manual intervention offers attractive savings. Direct on-line interchange is not necessarily required. The procedure may be (and in practice often is) as simple as physically transporting a magnetic tape reel from one installation to another, but for interchange to be possible a number of barriers has to be overcome.

0.3 The first barrier is that of machine and media incompatibility. If the equipment, or media, used by the participants is completely different, (perhaps one using flexible disks and another magnetic tape), direct interchange is clearly impossible although even this problem may be overcome by using the services of a third party to convert the media from one form to another.

With the increasing use of equipment with data transmission facilities, such incompatibility may be less significant. Packet switching systems, for example, may provide a method of establishing compatibility by matching equipment of one transmission speed to another of higher or lower speed. Data transmission may, however, introduce its own barriers associated with the representation of characters during transmission, or with the protocols used to keep equipment in synchronization or to detect the loss or corruption of data.

The foregoing problems are well recognized and are under consideration by national and international standards organizations.

0.4 The greatest barrier to data interchange, however, is usually at the user level. If only three organizations, each with its own independently designed data, records, and file structures, wish to interchange data, six conversion routines need to be programmed if each party insists on maintaining its own internal standards for the purpose of transmission. This number may increase exponentially as the number of interchange partners increases. If general interchange is to be practicable, common standards at the user level are absolutely essential.

These user standards have a direct parallel with written natural languages that have a vocabulary of commonly understood words, which on their own convey little

meaning, together with a grammar to link the words into meaningful statements.

0.5 This draft is based on the practical experience of organizations that, in developing interchange systems, have found that a move away from their own traditional record structures is essential to provide mutual acceptability, flexibility and effectiveness for existing and future systems. It defines both a formal grammar appropriate for machine communication (or the human interface with machines) and a limited vocabulary.

0.6 Just as the vocabulary of a natural spoken or written language needs to evolve and grow to meet the needs of those communicating, so a data interchange language needs also to evolve. There can be no possibility of providing a complete vocabulary to meet all needs for all time. DD 75 : Part 2* therefore incorporates a limited directory and sets out rules which users can follow to meet their own requirements.

0.7 In most written interchanges of data for commercial purposes a common name for the transaction is given and is associated with a generally understood content, e.g. the term 'invoice' generally implies a document carrying the name of a supplier and a purchaser, descriptions of the goods to be supplied, quantities and prices. Even greater formality is desirable for machine processing and therefore this Draft for Development goes a little beyond that which is normally understood by the term 'language' and includes rules for identifying the purpose of messages interchanged.

1. Scope

This Draft for Development describes a general-purpose language for the interchange of machine-readable data with the minimum of negotiation or agreement between interchange parties.

This Part contains:

- (a) a basic grammar, incorporating the required precision for computer processing, with extensions to meet specific application requirements;
- (b) general recommendations for the representation, for interchange purposes, of some frequently occurring categories of data;
- (c) administrative arrangements for data interchange.

The language covers only the data. It excludes all commands and protocols required to effect the transfer of the data and the activation of programs to process this data.

*In course of preparation.

The language is intended for use with any medium of interchange including:

- (a) telecommunication networks providing simultaneous transmission;
- (b) telecommunication networks using a store-and-forward service;
- (c) transfer of physical media such as magnetic tape.

The language is independent of the applications and equipment used. It is intended for computer-to-computer communication and has a structure that permits the necessary degree of manual processing to ensure operational integrity and flexibility.

2. References

The titles of the standards publications referred to in this Part of this Draft for Development are listed on the inside back cover.

3. Definitions

For the purposes of this Draft for Development the following definitions apply.

3.1 data element. A concept and associated attribute for which the definition, representation, identification and meaning has been agreed for the purpose of the interchange of data. It consists of a generic part representing a defined concept and an attribute, the data item.

Example:

colour of eyes, brown.

3.2 sub-element. An identifiable component, or part of a data element, that the interchange partners wish to process separately and that is separately delimited within the data element.

3.3 data item. An attribute of a data element or of a sub-element.

Example:

brown (for the data element 'colour of eyes'; brown).

3.4 group. A combination of selected data elements within a message.

3.5 message. A structural combination of data elements and/or groups used to transfer a set of information, e.g. one transaction, record or document.

3.6 batch. A set of messages treated as a unit within a transmission to facilitate processing by the sender or recipient.

3.7 transmission. The messages transmitted at one time between two organizations, either by a telecommunications link or by a physical medium such as magnetic tape, paper tape or cards.

3.8 data unit. An expression used to refer to a sub-element, element, group, message, batch or transmission or combinations of them.

3.9 tag; identification tag. An identifier allocated for use in place of a full name to facilitate a procedure that requires explicit identification without the overhead of interchanging full names.

3.10 mandatory data unit. A data unit that forms part of a higher level data unit (e.g. a data element within a group,

or a group within a message) and that is always included in the higher level data unit.

3.11 conditional data unit. A data unit that forms part of a higher level data unit (e.g. a data element within a group, or a group within a message) and that is only included in the higher level data unit under conditions defined in the specification of the higher level data unit.

Section one. Background information

4. Features of DIAL

4.1 Administration. Messages are interchanged between members of a group that, typically, is restricted to a particular application.

Each application has a maintenance body that defines data elements, groups and messages used within that interchange system. The maintenance body maintains a directory containing details and definitions of these data units. It is also responsible for informing members of changes to the directory.

This Draft for Development provides a common structure and a set of basic data elements that will facilitate any future amalgamation or intercommunication between different applications.

4.2 Messages. Data interchange using DIAL is in the form of *messages*. Typically, a message could correspond to a document or form as used in the traditional interchange of paper, or to any other type of transaction. A message can usually stand on its own and be communicated and processed independently, even though several messages may be put together for transmission at the same time.

A message (see figure 1) is composed of *data elements* (corresponding typically to boxes on a form). Some data elements are subdivided into *sub-elements* (corresponding to the situation where more than one piece of information is entered on the same box on a form). Related data elements in a message are linked in *groups*.

4.3 Character string format. Messages are formatted as a sequence of characters. What matters is the graphic characters that represent the data and the sequence in which they appear. Thus, in DIAL, extra spaces may be inserted between data elements in the interests of legibility.

Any non-printing control characters present are ignored. They are taken as being present solely to control the device or medium and not to modify the meaning of the printed string of characters, e.g. a long group may be interrupted by a carriage return/linefeed without altering the meaning.

To provide compatibility between different computers and networks, a restricted character set is used to represent the data.

4.4 Identification. The identity of messages, groups, data elements and sub-elements needs to be clear. Two methods of identification are used:

- (a) *explicit identification*, where the data unit is introduced by a pre-defined tag; and
- (b) *implicit identification*, where the data is defined by its position in a defined sequence.

Messages and groups are explicitly identified. Data elements may be identified by either method, and sub-elements are implicitly identified.

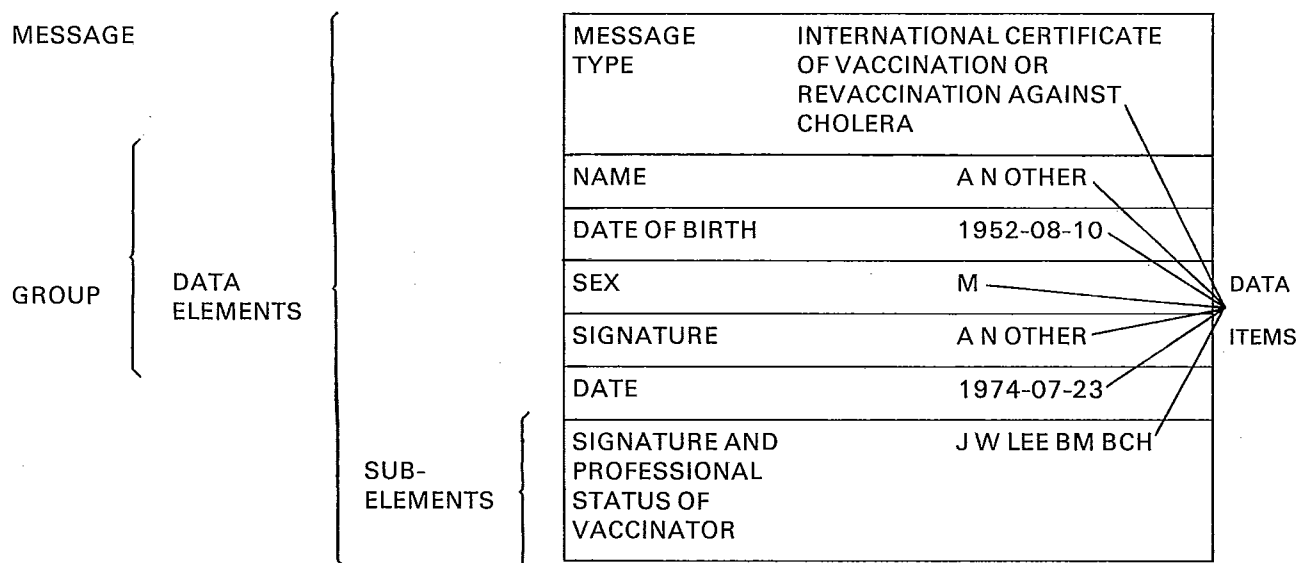


Figure 1. Composition of messages

4.5 Separation. The boundary between one data unit (sub-element, element, group or message) and the next is always explicitly marked. Tags are separated from the data they identify by a tag separator.

In a given environment the same data unit has the same tag, e.g. a data unit occurring in several different groups has the same tag in each.

The same separator is always used for the same function. Thus, a group is always terminated by an apostrophe which is the group separator, regardless of the contents of the group or the message in which it appears.

4.6 Standard representation. Appendix D defines the representation of the more common data elements such as amounts, units of measure, currencies, dates and times.

NOTE. DD 75: Part 2* will provide the basic vocabulary which may be developed to suit individual applications.

Standard formats are provided for groups such as message headers and trailers.

4.7 Core and extensions. A 'core' language with a simple grammar is defined. For many applications this will be adequate but, where more flexibility is needed, the extensions provided in section three may be used. These extensions follow the same principles as the core and are entirely compatible with it, but they require more complex facilities.

4.8 Flexibility. The foregoing techniques permit considerable flexibility in message design, both to meet the differing needs of individual organizations involved in interchange and to permit modifications to be introduced with minimum disruption.

4.9 Robustness. As interchange involves the interaction of independent computer systems, errors and malfunctions will naturally occur more frequently than in systems under a single control. Therefore, special attention is paid in the message structuring to the provision of considerable robustness and ease of recovery. Thus, a group tag is identifiable both from the separator which precedes it and from the fact that it is a three-letter tag preceding a tag separator.

*In course of preparation.

4.10 Error correction. Errors present a particular problem in interchange, because a sender who wishes to correct an error that he has detected seldom knows whether the transmission of a correction message can have the desired effect. DIAL describes some basic error correction procedures for use in situations where such a facility has to be provided. They should be used with extreme caution, however, not only because of the problems surrounding error correction, but also because automatic error correction is so rare that the messages specified, unlike the rest of the language, are not based on very well tested techniques in wide usage.

Section two. Formal description

5. General

This section describes the 'core' language of DIAL to be used by all interchange systems. Optional extensions to this core are described in section three.

6. Administration

Each interchange system uses a data directory which is administered by a maintenance body (see 4.1). The data directory lists the data elements, groups and messages used in that system. A number of frequently used data units, defined in this Draft for Development, are common to all interchange systems.

All interchange systems need to use the syntax rules of DIAL.

7. Data elements

7.1 A data element is used to record a single item of information in isolation.

7.2 In the specification of data elements for interchange, the following are required.

- A natural language name of the data element, e.g. date of birth. This will be used in documentation associated with the interchange. There may be more than one natural language name for each data element.
- A definition that clarifies any potential ambiguities

in the data element name; e.g. the data element 'date of birth' might have the definition 'calendar date of birth as legally registered'.

(c) A unique 4-character *tag* for the data element, e.g. BTHD. This identifier may be a mnemonic or other abbreviation of the data element name.

(d) A method of representation for the data item. This should specify at least the type of characters and the maximum length, e.g. six numeric characters. It may also specify:

- (1) a unique form of representation such as a code, e.g. the 2-letter country code as specified in BS 5374, where the data element will be used as a key for matching;
- (2) valid forms of representation, e.g. leading zeros may be added or deleted up to the maximum length.

8. Groups

A group is used to link logically related data elements. Grouping helps the handling of nested and repeating data.

Typically, each group will contain the following:

- (a) a natural language name, if appropriate, e.g. 'routing';
- (b) a definition, e.g. 'transit points in cargo movement';
- (c) a list of data elements that may be present and a statement of whether these elements are mandatory or conditional; a group may contain a single data element;
- (d) a unique 3-character identification tag, e.g. 'RTG'.

NOTE. See DD 75 : Part 2 for further information.

9. Messages

A message is used to communicate a transaction, notification or request.

Typically, each message will contain the following:

- (a) a natural language name, e.g. 'advice note';
- (b) a definition for the purpose of common understanding by both the sender and receiver of the message, e.g. 'notification of despatch of goods to the customer';
- (c) a list of data groups that may be present and a statement of whether these data groups are mandatory or conditional;
- (d) a unique 6-character identification tag, e.g. 'ADVICE', that is used for each occurrence of the same type of message.

NOTE. See DD 75 : Part 2 for further information.

10. Transmissions

A transmission comprises all the data that is sent at one time.

A transmission has no pre-defined name or identification tag, although a reference may be allocated by the sender to identify a particular transmission.

Messages included in a transmission need not be logically related.

11. Character set

The character set of DIAL consists of:

- (a) letters of only one case, e.g. A to Z;

(b) the digits 0 to 9;

(c) space;

(d) the symbols ., / () - ? : + = ' "

(e) and, where agreed for the interchange system (see clause 6), the symbols * ! ; & % "

DIAL is not concerned with the coding of these characters.

NOTE 1. The characters in categories (a), (b), (c) and (d) are a subset of characters included in CCITT International Alphabets 2 and 5. They may therefore be used in the widest range of equipment.

NOTE 2. The characters in category (e) are found on most computers and may be used in interchange systems where there is no requirement to use telex either operationally or as fallback.

NOTE 3. Additional information on character sets and coding is provided in appendix C.

12. Syntax characters

DIAL uses the following syntax characters to separate and terminate data units.

12.1 Data element separator (+). Data elements within a group are separated from each other by the data element separator, a plus sign (+).

Example:

...+ABC+123+...

12.2 Sub-element separator (:). Sub-elements within a data element are separated from each other by the sub-element separator, a colon (:).

Example:

...+15.2:KG+...

mass unit of mass.

12.3 Tag separator (=). The data is separated from a tag by the separator, an equals sign (=).

Example:

RTG=LONDON+DOVER+CALAIS+... where RTG is an example of a group tag.

12.4 Terminator ('). Data groups are terminated by the terminator, an apostrophe (').

Example:

...+CALAIS+PARIS'

13. Release character (?)

Where a syntax character is required as part of a data item, the release character, a question mark (?), is used. The release character is inserted immediately preceding each occurrence of a syntax character which is to be interpreted as a data character. It signifies that the next single character is not to be interpreted as a syntax character.

Where the release character is itself included in data, it also is preceded by the release character.

Example 1:

data item required 75+73+ABC
data transmitted 75?+73?+ABC

Example 2:

data item required HOW MANY PACKAGES?
data transmitted HOW MANY PACKAGES??

NOTE. Syntax characters should be excluded from data items wherever possible. They may often be replaced by another

character without loss of meaning, e.g. a space character may replace an apostrophe, thus O'REILLY may be transmitted as O REILLY.

14. Structure of groups

The structure of a group is built up by using syntax characters to link together data elements (and sub-elements) as shown in figure 2.

15. Structure of messages

A message (see figure 3) consists of:

- (a) a message header group;
- (b) one or more data groups;
- (c) a message trailer group.

NOTE. Message header and message trailer groups are described in clause 18.

16. Structure of transmissions

A transmission consists of the following (see figure 4):

- (a) a start flag consisting of four opening brackets ((((;
- (b) a start of transmission group;

- (c) one or more complete messages;
- (d) an end of transmission group;
- (e) an end flag consisting of four closing brackets)))).

NOTE. Start of transmission and end of transmission are described in clause 18.

17. Overall structure

The overall structure of a transmission is illustrated in figure 5.

18. Structuring groups

18.1 General. Start and end of transmission groups and message header and trailer groups are known as structuring groups. Their contents are briefly described in this clause.

18.2 Start of transmission group (STX). The start of transmission group contains the following mandatory information:

- (a) the syntax rules being used;
- (b) the sender and recipient of the transmission;

Group	XXX=XXXXXXX:XXX+XXXXXXXXXXXXX+XXXXXX+X+XXX:XX'
Group tag	XXX
Data elements	XXXXXX:XXX XXXXXXXXXXXXX XXXXXX X XXX:XX
Sub-elements	XXXXXX XXX XXX XX
Syntax characters	= : + + + + : '

Figure 2. Structure of groups

Message	Message header	Data group	Data group	...	Message trailer
Structure groups	Message header				Message trailer
Data		Data group	Data group	...	

Figure 3. Structure of messages

Start flag	Start of transmission group	MESSAGE	MESSAGE	MESSAGE	End of transmission group	End flag
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Figure 4. Structure of transmissions

TRANSMISSION													
(((	STX	MESSAGE 1			MESSAGE 2			...	MESSAGE n			END	)))
		MHD	Data	MTR	MHD	Data	MTR		MHD	Data	MTR		

(((	Start flag	MTR	Message trailer group
STX	Start of transmission group	END	End of transmission group
MHD	Message header group	)))	End flag
Data	Data groups		

Figure 5. Overall structure of a transmission

- (c) the date of transmission;
- (d) the sender's reference for the transmission.

It may also contain the following conditional information:

- (e) the particular set or subset of syntax rules;
- (f) the time of transmission;
- (g) the recipient's reference for the transmission;
- (h) an application code (to enable, for example, a recipient to identify, at the transmission level, whether the transmission contains data for an import application, an export application, or an account, etc.);
- (i) a priority code.

18.3 End of transmission group (END). The end of transmission group contains one mandatory data element consisting of the number of messages in the transmission. The count of messages includes all data and control messages but excludes the STX and END groups.

Example:

END=1' indicates a transmission consisting of one message; END=25' indicates a transmission containing 25 messages.

18.4 Message header group (MHD). A message header group consists of the following mandatory data elements:

- (a) *the message reference*, which is any unique reference allocated by the sender;
- (b) *the message type*, consisting of the two sub-elements
 - (1) *the message tag*, and
 - (2) *the version number*, allocated by the maintenance body, to distinguish different versions of a message arising from amendments to the message specification; version numbers are restricted to the range 1 to 9; after version 9 the version number reverts to 1.

Example:

MHD=123+QUOTTN:2' where 123 is the message reference allocated by the sender and where 2 refers to the second version of the specification for the message type QUOTTN.

NOTE 1. The following message tags are reserved for syntax purposes and may not be used for other purposes, AMEND, CANCEL, CHANGE, FORMAT, NONSTD, REVISE.

NOTE 2. The use of the version number protects recipients of messages during the changeover period from one version to another.

18.5 Message trailer group (MTR). The message trailer group consists of one mandatory data element consisting of the number of groups in the message. The count of groups includes both MHD and MTR groups.

Example:

MTR=7' indicates that the message consists of seven groups.

19. Identification of data elements and sub-elements

19.1 General. Data elements within a group should be identified either:

- (a) implicitly, by specification of the sequence of data elements within the group; or
- (b) explicitly, by the use of tags.

Only one method of identification should be used within any one group but both methods may be used within a message.

For sub-elements, implicit identification only should be used.

NOTE. Implicit identification of data elements is generally suitable for groups whose content is stable. It has the advantage that there is no overhead in the transmission associated with the inclusion of data element tags. Structuring groups (see clause 18) use implicit identification.

Explicit identification (or implicit identification using format groups described in clause 24) accommodates a wide variation in the composition of a group and also facilitates a change in group composition with less inconvenience to participants.

In practice, applications tend to use both methods.

19.2 Implicit identification. In implicit identification, each data item in a group is identified by its predefined position within that group. The definition of each group is specified as part of the interchange agreement. In the extensions to DIAL, this definition may be varied within a transmission by the use of a format group (see clause 24).

A data element that is not required in a group may be omitted, and the omission should be indicated by the inclusion of the appropriate separator character, but if the omission occurs at the end of the group, the group may be truncated.

Examples:

Suppose data elements A, B, C, D comprise a group with group tag GRP and the corresponding data items are AAA, B, CC and DDDD. Then

- (a) for all elements included

GRP=AAA+B+CC+DDDD'

- (b) when there is no data for C

GRP=AAA+B+DDDD'

- (c) when there is no data for either C or D

GRP=AAA+B'

- (d) when there is no data for A, B, C or D and the group is specified as conditional, it may be omitted from the message.

Sub-elements within a data element may be omitted similarly.

Example:

Countries may be defined in the data directory with a code and a clear sub-element, in which case any of the following may be transmitted:

...+US:UNITED STATES+...

...+US+...

...+:UNITED STATES+...

19.3 Explicit identification. In explicit identification, each data item in a group should be identified by a data element tag which precedes the data item. The data item is separated from the data element tag by the tag separator (=).

Example:

Group tag=data element tag=data item+data element tag=data item...

Example:

MHD=...(message header group)...

GDS=ITEM=BATH+MATL=CAST IRON+FNSH=VITREOUS ENAMEL+SIZE=2:M+QNTY=1'