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Proposed Federal Information Processing Standard

SPECIFICATION FOR MESSAGE FORMAT FOR COMPUTER BASED MESSAGE SYSTEMS

National Bureau of Standards
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TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY 1

1. INTRODUCTION 3

1.1 Guide to Reading This Document 3
1.2 Vendor-Defined Extensions to the Specification 4
1.3 The Scope of the Message Format Specification 4
1.4 Issues Not Within the Scope of the Message Format Specification 4
1.5 Relationship to Other Efforts 5

2. A SIMPLE MODEL OF A CBMS ENVIRONMENT 6

2.1 Logical Model of a CBMS 8
2.2 Relationship to the ISO Reference Model for Open Systems Interconnection 10
2.3 Messages and Fields 10
2.4 Message Originators and Recipients 11

3. SEMANTICS 12

3.1 Semantics of Message Fields 12
3.1.1 Types of fields 12
3.1.2 Semantic Compliance Categories 13
3.1.3 Originator fields 13
3.1.4 Recipient fields 14
3.1.5 Date fields 15
3.1.6 Cross-reference fields 16
3.1.7 Message-handling fields 16
3.1.8 Message-content fields 17
3.1.9 Extensions 18

3.2 Message Processing Functions 18
3.2.1 Message creation and posting 19
3.2.2 Message reissuing and forwarding 20
3.2.2.1 Redistribution 22
3.2.2.2 Assignment 22
3.2.3 Reply generation 23
3.2.4 Cross referencing 24
3.2.4.1 Unique identifiers 24
3.2.4.2 Serial numbering 24
3.2.5 Life span functions 25
3.2.6 Requests for recipient processing 25
3.2.6.1 Message circulation 26
3.3 Multiple Occurrences and Ordering of Fields 26

4. SYNTAX 28

4.1 Introduction 28
4.1.1 Message structure 28
4.1.2 Data elements 29
4.1.2.1 Primitive data elements 30
4.1.2.2 Constructor data elements 30
4.1.3 Properties 30
4.1.3.1 Printing-names 30
4.1.3.2 Comments 31
4.1.4 Data compression and encryption 31
4.1.5 Data sharing 31
4.2 Overview of Syntax Encoding 32
4.2.1 Identifier Octets 32
4.2.2 Length code and Qualifier components 33
4.2.2.1 Length Codes 35
4.2.2.2 Qualifier 36
4.2.3 Property-List 38
4.2.4 Data Element Contents 38
4.3 Data Element Syntax 39
4.3.1 Data elements 39
4.3.1.1 Primitives 42
4.3.1.2 Constructors 44
4.3.2 Using data elements within message fields 48
4.3.3 Properties and associated elements 49
4.3.4 Encryption identifiers 49
4.3.5 Compression identifiers 49
4.3.6 Message types 50

SUMMARY OF APPENDIXES 51

APPENDIX A. FIELDS -- IMPLEMENTORS' MASTER REFERENCE 52

APPENDIX B. DATA ELEMENTS -- IMPLEMENTORS' MASTER REFERENCE 57

APPENDIX C. DATA ELEMENT IDENTIFIER OCTETS 65

APPENDIX D. SUMMARY OF MESSAGE FIELDS BY COMPLIANCE CATEGORY 66

D.1 REQUIRED Fields 66
D.2 BASIC Fields 66
D.3 OPTIONAL Fields 66

APPENDIX E. SUMMARY OF MESSAGE SEMANTICS BY FUNCTION 68

E.1 Circulation 68
E.2 Cross Referencing 68
E.3 Life spans 68
E.4 Delivery System 68
E.5 Miscellaneous Fields Used Generally 69
E.6 Reply Generation 69
E.7 Reissuing 69
E.8 Sending (Normal Transmission) 69

APPENDIX F. SUMMARY OF DATA ELEMENT SYNTAX 70

APPENDIX G. SUMMARY OF DATA ELEMENTS BY COMPLIANCE CATEGORY 72

G.1 BASIC Data Elements 72
G.2 OPTIONAL Data Elements 72

APPENDIX H. EXAMPLES 74

H.1 Primitive Data Elements 74
H.2 Constructor Data Elements 76
H.3 Fields 81
H.4 Messages 84
H.5 Unknown Lengths 88

REFERENCES 92

INDEX 94

LIST OF FIGURES

FIG. 1.	LOGICAL MODEL OF A COMPUTER BASED MESSAGE SYSTEM	8
FIG. 2.	MESSAGE FORWARDING AND REDISTRIBUTION	21
FIG. 3.	EXAMPLE OF MESSAGE CIRCULATION	27
FIG. 4.	STRUCTURE OF IDENTIFIER OCTETS	34
FIG. 5.	ENCODING MECHANISM FOR QUALIFIERS AND LENGTH CODES	35
FIG. 6.	REPRESENTATION OF LENGTH CODES	36
FIG. 7.	EXAMPLES OF LENGTH CODES	37
FIG. 8.	EXAMPLES OF QUALIFIER VALUES	38

LIST OF TABLES

TABLE 1. FIELDS USED IN MESSAGE PROCESSING FUNCTIONS 19
TABLE 2. TYPE BITS IN THE IDENTIFIER OCTET 33

EXECUTIVE SUMMARY

The message format specification addresses the problem of exchanging messages between different computer-based message systems (CBMSs). This interchange problem can be addressed on several levels. One level specifies the physical interconnections, another specifies how information travels between CBMSs, another specifies form and meaning of messages being interchanged. The highest level specifies operations on a message. Each of these levels would be covered by a different standard.

This message format specification addresses only the issues of form and meaning of messages at the points in time when they are sent from one CBMS and received by another. Messages are composed of fields, containing different classes of information. These fields contain information about the message originator, message recipient, subject matter, precedence and security, and references to previous messages, as well as the text of the message. Standard formats (syntax) for messages ensure that the contents of messages generated by one CBMS can be processed by another CBMS. Standard meanings (sematics) for the components of a message ensure standard interpretation of a message, so that everyone receiving a message gets the meaning intended by its sender.

Each CBMS that implements this message format specification will be compatible with any other CBMS that implements the specification. Compatibility ensures that the contents of a message posted by one CBMS can be received and interpreted by a different CBMS.

This message format specification has been developed as a result of examining CBMSs currently in use in commercial and research environments. Three major design perspectives helped shape the message format specification.

- Viability. The message format specification uses concepts that already work. It has been designed with implementation concerns in mind.

- Compatibility. The message format specification contains concepts from existing CBMSs. For this reason, many CBMS would already contain functions and components similar to those required to implement the message format specification.

- **Extensibility.** This message format specification defines a broad range of message content components and requires only an elementary subset of them. This means that even a very simple CBMS can implement the message format specification. The message format specification contains a rich set of optional components and, in addition, mechanisms for user extensions and future extensions to the message format specification.

The message format specification defines the form and meaning of message contents and their components as they pass from one CBMS to another through a message transfer system. The message format specification does not address any of the following major issues.

- **Functions or services provided to a user by a CBMS.**
  For example, the message format specification assumes that every CBMS allows a user to send and receive messages. It does not specify any of the details of how a send function or a message-reading function might work or how it might appear to the user. That is, the message format specification neither limits nor mandates functions.

- **Storage or format of message contents in a CBMS.**
  The message format specification defines the form and contents of messages when they are transferred between systems. A CBMS may or may not choose to use the same format for internal storage.

- **Message transfer system protocols.**
  The message format specification does not specify how a message travels between CBMSs. It does specify the form of its contents as it leaves and arrives, assuming only that the message is moved transparently by the transfer system.

- **Message envelopes.**
  While a message is traveling between CBMSs, it is enclosed in a message envelope. Message envelopes contain all the information about a message that a message transfer system needs to know. The message format specification does not define the format or content of a message envelope.

- **How message originators and recipients are identified.**
  The message format specification does not provide a representation scheme for the names or addresses of message originators and recipients as they are known to a CBMS.

1. INTRODUCTION

A computer-based message system (CBMS) allows communication between "entities" (usually people) using computers. Computers serve both to mediate the actual communications between systems and to provide users with facilities for creating and reading the messages.

CBMSs have been developing for over ten years. More recently, CBMSs have been one of the bases in industry for the introduction of office automation. A growing number of organizations use either their own or a commercially available CBMS. The design and complexity of these systems vary widely. This message format specification provides a basis for interaction between different CBMSs by defining the format of messages passed between them.

1.1 Guide to Reading This Document

The method of presenting the material in this specification is to combine the technical specification with tutorial information. This approach has been taken to place the specification in context and improve its readability.

The core of the technical information in the document is in Section 2 "A Simple Model of a CBMS Environment", Section 3.1 "Semantics of Message Fields", Section 4.2 "Overview of Syntax Encoding", and Section 4.3 "Data Element Syntax". Appendixes A and B consolidate the technical informations. These appendices are designed for ease of reference and should be read in conjunction with the body of the report for a complete understanding of the message format presented in the specification.

Section 2 presents a simple model of operation of a CBMS. Section 3 discusses the components of messages and their meaning (semantics). This includes discussions of the recommended relationship between message components and CBMS user functions. (See Section 3.2.) Section 4 presents details of the form (syntax) required for components of a message.

Appendix D summarizes the components of messages according to whether they are required or optional for CBMSs implementing the message format specification. Appendix E organizes the message components according to the functional class of the components. Appendix F provides an overview of the syntactic elements defined by this message format specification; Appendix G

summarizes those elements according to whether they are required or optional for a CBMS implementing the message format specification. Examples of each syntactic element appear in Appendix H, displaying syntax and describing the associated semantics.

1.2 Vendor-Defined Extensions to the Specification

This specification provides the capability of extending the range of functionality by the use of vendor-defined qualifiers and vendor-defined data elements. Any vendor who uses this capability to provide services which are essentially equivalent to those already designated as required, basic, or optional does not comply with the specification.

1.3 The Scope of the Message Format Specification

The purpose of this message format specification is to present the semantics and syntax to be used for messages being exchanged between CBMSs. Specifically, it defines the following.

- The meaning and form of standard fields to be used in messages.
- Which fields must be present in all messages.
- Which fields complying CBMSs must be able to process.
- How messages, fields, and the data contained in fields are represented.

1.4 Issues Not Within the Scope of the Message Format Specification

The message format specification does not address the following issues, some of which are being covered by other NBS standards developments. (See [BlaR-80] for a description of the NBS protocols program.)

- The nature of a message transfer system, except to state the assumption that it transfers messages transparently.

- The form or nature of the protocols used to transfer messages (posting, relay, and delivery protocols).
- The content and representation of message envelopes.
- Representations for unique identifiers (in particular, message identifiers).
- Network and internetwork addressing.
- Representations for identities of message originators and recipients.
- Functions that CBMSs provide for users.
- Presentation of messages to users.
- Representations for multi-media objects.
- Data representation for messages within CBMSs.
- Data sharing or any storage management within CBMSs.
- Representations for fixed or floating point numbers.

1.5 Relationship to Other Efforts

The message format specification is based on several documents and the current state of many CBMSs available both in industry and the research community. These documents include the standardization efforts in the ARPANet [CroD-77, PosJ-79] and the CCITT, proposed ISO and ANSI header format standards [TasG-80, ISOD-79], the work of IFIPS Working Group 6.5, and various papers about the general nature of mail systems, addressing, and mail delivery. (See [FeiE-79] for references.

2. A SIMPLE MODEL OF A CBMS ENVIRONMENT

In order to provide a framework for presenting the message format specification, this section describes a simple functional model for a CBMS. The model provides a high-level description of both user facilities and system architecture. Discussions of messages, message originators and message recipients serve to further clarify the nature of a CBMS.

A CBMS permits the transfer of a message from an originator to a recipient. "Originator" and "recipient" are used in their normal English senses. (See Section 2.4.) A message (in its most abstract definition) is simply a unit of communication from an originator to a recipient. A CBMS offers several classes of functions to its users:

- Message Creation: The facilities used by a message originator to create messages and specify to whom they are to be sent.
- Message Transfer: The facilities used to convey a message to its recipient(s).
- Recipient Processing: The facilities used by a message recipient to process messages that have arrived.

These classes of functions are presented in more detail in Section 3.2.

CBMSs differ from other office automation/communications systems in a number of ways.

- Unlike other types of electronic communications, CBMS messages are sent to particular individuals, not to stations or telephone sets. If a recipient moves to a different location, messages sent to that recipient are delivered to the recipient at the new location.
- Transmission of CBMS messages is asynchronous. The recipient's system need not be available when the message leaves the originator's system. That is, CBMS message transfer facilities are store-and-forward.
- CBMS messages can contain a wide variety of data. They are not constrained to any single kind of communication. CBMS messages are often simple memoranda but are not restricted to text. A CBMS message may contain any kind

of data that an originator wishes to send to a recipient. By contrast, Teletex systems and communicating word processors handle the transfer of final form documents; compatible communicating word processors can exchange documents in editable form; Telex and TWX deal in unformatted text.

- CBMSs offer message creation facilities as an important part of the system. CBMSs assist users in the preparation of messages by having text editing facilities available and allowing users to include data stored on-line in messages. Some CBMSs also interface to other office automation facilities, such as formatters and spelling correctors. This is not true of Telex, TWX, or similar services.

- CBMSs offer recipient processing facilities as an important part of the system. This is not true of most other forms of electronic communications. For example, Telex and TWX systems simply print messages on paper when they are received, without retaining a copy in the system. (Teletex systems are similar to Telex systems, but some can retain a copy of the document in local storage.) Communicating word processors might notify their operators that a document has been received and is stored on-line, but offer little in the way of other recipient processing facilities. Most CBMSs offer at least the following recipient processing facilities.

  . The ability to retain a copy of a message on-line after it has been read.

  . The ability to examine or delete stored messages individually.

  . The ability to organize messages using some form of electronic "file folder".

  . The ability to determine if a message is recent (has arrived since the last time the recipient used the CBMS) or unseen (has never been examined by the recipient).

  . The ability to summarize stored messages. A summary usually includes information such as whether the message is recent or unseen, when it was received, its length, who it is from, and its subject.

  . The ability to retrieve a stored message based upon

one or more of its attributes (for example, when the message was received, whether or not it has been seen or deleted, and the values contained in its fields).

. A forward facility that allows users to include all or part of a message in a new outgoing message.

. A reply facility that allows users to answer messages without having to enter a new list of recipients.

2.1 Logical Model of a CBMS

CBMS facilities for message creation, transfer, and recipient processing are reflected in a logical model of a CBMS developed by IFIP Working Group 6.5 [SchP-79]. (An essentially identical model is being used by CCITT Study Group VII, Question 5, regarding Message Handling Facilities.) The model consists of a Message Transfer System and a number of User Agents. (See Figure 1.)

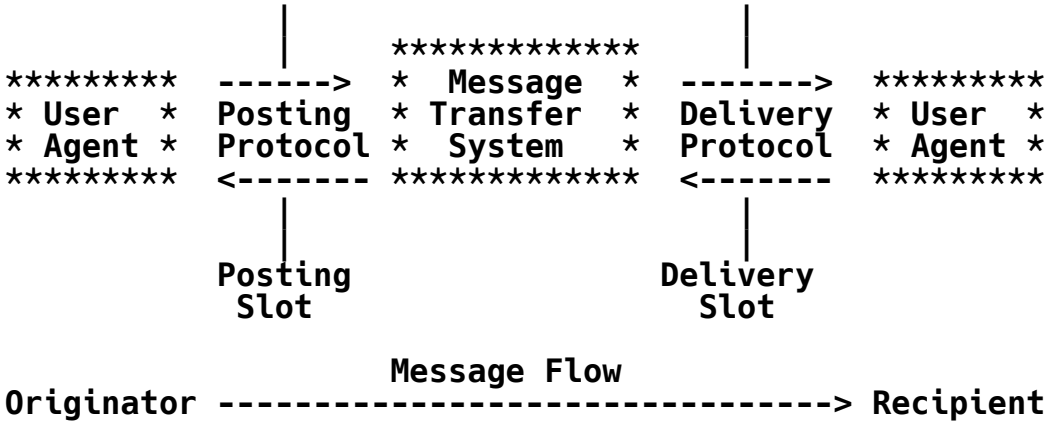

FIG. 1. LOGICAL MODEL OF A COMPUTER BASED MESSAGE SYSTEM

A User Agent is a functional entity that acts on behalf of a user, assisting with creating and processing messages and communicating with the Message Transfer System.

The Message Transfer System] is an entity that accepts a

message from its originator's User Agent and ultimately passes it to each of its recipients' User Agents. The Message Transfer System may perform routing and storage functions (among others) in order to accomplish its task.

Transferring a message from an originator's User Agent to the Message Transfer System is called Posting; the originator's User Agent and Message Transfer System engage in a Posting Protocol in order to accomplish Posting. Transferring a message from the Message Transfer System to a recipient's User Agent is called Delivery; the recipient's User Agent and Message Transfer System engage in a Delivery Protocol in order to accomplish Delivery.

The point at which responsibility for a message is transferred is called a Slot. The Posting Slot is the point at which responsibility for a message passes from an originator's User Agent to the Message Transfer System; the Delivery Slot is the point at which responsibility for a message passes from the Message Transfer System to a recipient's User Agent.

The model divides messages into two parts, the message content and the message envelope. The message content is the information that the originator wishes to send to the recipient; this message format specification deals solely with the message content. The message envelope consists of all the information necessary for the Message Transfer System to do its job; this message format specification does not specify the message envelope. Some of the data appearing on the message envelope could be redundant with some data found in the message content. The Message Transfer System is not expected to examine the message content unless it is told to do so by the originator's or recipient's User Agent.

This message format specification places no restrictions on the Message Transfer System itself, except that it be transparent to the contents of messages. In addition, this message format specification does not dictate the form or nature of any protocol used by the Message Transfer System. Finally, this message format specification does not specify the content or form of the message envelope. That is, the message format specification defines the format for the contents of messages, not the manner in which they are transmitted.

Many of today's commercially available CBMSs incorporate all of the facilities represented in the logical model. Their architectures may reflect the economies that can be taken when implementing systems that are self-contained. For example, stand-alone systems that store messages in a single central database require no Message Transfer System; an implementation may integrate software for User Agent and Message Transfer System functions, doing away with Posting or Delivery Protocols.

2.2 Relationship to the ISO Reference Model for Open Systems Interconnection

Subcommittee TC97/SC16 of the International Standards Organization (ISO) has developed a reference model for describing communications between "open" systems [ISOD-81]. This model is known as the ISO Reference Model for Open Systems Interconnection (OSI). It divides communications protocols into seven layers, ranging from physical interconnection at the lowest layer to data exchange by application programs at the top.

This message format specification deals with data used by an application within a system. Thus, the message format being specified here is not a protocol. Since it is not a protocol, it lies outside of the model for open systems interconnection. User Agents are application layer entities (layer 7), however, and the protocols used by a message transfer system are above the session layer (layer 5).

2.3 Messages and Fields

A message is a unit of communication from an originator to a recipient. A message consists of a series of components called fields. Fields can be described according to their meaning in a message (semantics) and according to the format required for them in a message (syntax).

Semantically, a field is just a component of a message; the meanings of particular fields are defined by this message format specification. Syntactically, a field is a unit of data whose form is defined by this message format specification. Additional fields can be defined by users or vendors as long as they conform to the syntactic and semantic rules that this message format specification defines for additional fields.

(A note on terminology: A message consists of components called fields. The words "message" and "field" are used both in the informal sense of the previous sentence and in a more restricted sense as names of particular syntactic elements. As syntactic element names, Message and Field are always capitalized.)

Some CBMS functions are based on the contents of particular fields; other functions (such as the ability to read a message) may have little to do with the fields themselves. Section 3.2 discusses some of the specific functions that a CBMS might provide to users and the fields that must be used to support those functions.

2.4 Message Originators and Recipients

This message format specification refers to message originators and recipients. These terms were defined functionally in Figure 1. When the message format specification refers to the identity of a message originator or recipient, it means "that information which uniquely identifies the message originator or recipient within the domain of the given message system." The syntax and semantics of message addressing are not within the scope of the message format specification.

Originators and Recipients can be people, roles, or processes.

People. People as originators and recipients are specific individuals.

Roles. Roles identify functions within organizations as opposed to the specific individuals who perform them. For example, consider a newspaper that produces both morning and evening editions and therefore operates with more than one shift. Someone wishing to contact the city desk would send a message to the city desk role rather than trying to determine exactly who was assigned to the city desk at a specific time. (Of course, messages can usually be sent to the individuals directly whether or not they are actually performing a role at the time.)

Processes. A process in a computer could serve as either an originator or a recipient for messages. A computer system might originate a message to notify a recipient about the status of some task. For example, an archive utility could notify users about files that have been archived; a distributed file system could notify a user that a remote file has been deposited on a local file system. Messages could be used by computer systems to warn about some impending condition or even to monitor the performance of the computer itself. Some computer processes may also be message recipients, taking action based upon message contents.

In addition, some CBMSs allow messages to be sent to groups. A group is a predefined list of message recipients. Using a group name as a recipient permits message originators to designate a potentially large number of recipients using a single recipient identifier. This makes using the CBMS more convenient and accurate.

3. SEMANTICS

This section discusses two major topics, message processing functions and message field meanings. Section 3.1 describes the six functional groups of message fields. The functional groups are Origination, Dates, Recipients, Cross-referencing, Message-handling, and Message-contents. They are explained more fully in Section 3.1.1, along with detailed discussion of the semantics of all the fields in each functional group. Section 3.2 describes message processing functions whose operation is based on the meanings of particular message fields.

3.1 Semantics of Message Fields

The definition of a message is discussed generally in Sections 1 and 2. Semantically valid messages must contain one From field, one To field, and one Posted-Date field. They may contain, in addition, any number of other fields, depending on the processing and functions supplied by the originating or receiving CBMS. (Section 3.2 describes classes of functions supplied by CBMSs.)

3.1.1 Types of fields

Message receiving programs are required to interpret fields according to the semantics described in the remainder of this se. The message fields defined in this document are grouped into the following functional categories.

- Originator fields indicate who or what participated in the creation of the message and where replies should be directed. (See Section 3.1.3.)
- Date fields record when events take place, for a variety events, such as message creation or expiration. (See Section 3.1.5.)
- Recipient fields indicate who or what is intended to receive a message. (See Section 3.1.4.)
- Cross-reference fields label a message or refer to other messages. (See Section 3.1.6.)
- Message-handling fields record the type of service a

message's sender requested of a message transfer system or indicate how the message should be treated by its recipients. (See Section 3.1.7.)

- Message-content fields either contain the primary content of a message or index or summarize it. (See Section 3.1.8.)

- Extension fields provide mechanisms for extending the message format specification. (See Section 3.1.9.)

3.1.2 Semantic Compliance Categories

For purposes of determining whether a CBMS complies with the semantic requirements of this message format specification, message fields have been divided into three categories:

REQUIRED These fields must be present in all messages and must be processed by message receiving programs as defined by the message format specification.

BASIC These fields need not be present in all messages but when they do appear they must be processed by message receiving programs as defined by the message format specification.

OPTIONAL These fields need not be present in all messages and may be ignored by message receiving programs. The exact meaning of "ignored" is not specified by the message format specification. In general, a CBMS must recognize the existence of an optional field (that is, optional fields should not cause errors) and must not process the field in a manner contrary to the semantics defined for that field by the message format specification.

(Syntactic compliance is defined in Section 4.1.2.)

3.1.3 Originator fields

A message originator may be a person, role, or process. Originator fields identify a message's author, who is responsible for the message, who or what sent it, and where any replies should be directed. (See Section 2.4.)

From (REQUIRED)

This field contains the identity of the originator(s) taking formal responsibility for this message. The contents of the From field is to be used for replies when no Reply-to field appears in a message.

Reply-To (BASIC)

This field identifies any recipients of replies to the message.

Author (OPTIONAL)

This field identifies the individual(s) who wrote the primary contents of the message. Use of the Author is discouraged when the contents of the Author field and the From field would be completely redundant.

Sender (OPTIONAL)

This field identifies the agent who sent the message. It is used either when the sender is not the originator responsible for the message or to indicate who among a group of originators responsible for the message actually sent it. Use of the Sender field is discouraged when the contents of the Sender field and From field would be completely redundant. Only one Sender field is permitted in a message.

3.1.4 Recipient fields

Message recipients may be people, roles, or processes. (See Section 2.4). Recipient fields identify who or what is to receive the message.

To (REQUIRED)

This field identifies the primary recipients of a message.

Bcc (OPTIONAL)

This field identifies additional recipients of a message (a "blind carbon copies" list). The contents of this field are not to be included in copies of the message sent to the primary and secondary recipients. See section 3.2.1 for further discussion of the use of blind carbon copies lists.

Cc (BASIC)

This field identifies secondary recipients of a message (a "carbon copies" list).

Circulate-Next (OPTIONAL)

This field is used in conjunction with the Circulate-To field. (See Section 3.2.6.1.) It identifies all recipients in a circulation list who have not received the message.

Circulate-To (OPTIONAL)

This field identifies recipients of a circulated message. (See Section 3.2.6.1.) It is used in conjunction with the Circulate-Next field.

3.1.5 Date fields

Date fields for two kinds of uses are provided. Dates can be associated with some event in the history of a message and dates can delimit the span of time during which the message is meaningful (its life span).

Posted-Date (REQUIRED)

This field contains the posting date, which is the point in time when the message passes through the posting slot into a message transfer system. Only one Posted-Date field is permitted in a message.

Date (OPTIONAL)

This field contains a date that the message's originator wishes to associate with a message. The Date field is to the Posted-Date field as the date on a letter is to the postmark added by the post office.

End-Date (OPTIONAL)

This field contains the date on which a message loses effect. (See also Section 3.2.5.)

Received-Date (OPTIONAL)

Delivery date. This field may be added to a message by the recipient's message receiving program. It indicates when the message left the delivery system and entered the recipient's message processing domain.

Start-Date (OPTIONAL)

This field contains the date on which a message takes effect. (See also Section 3.2.5.)

Warning-Date (OPTIONAL)

This field is used either alone or in conjunction with an End-Date field. It contains one or more dates. These dates could be used by a message processing

program as warnings of an impending end-date or other event. (See also Section 3.2.5.)

3.1.6 Cross-reference fields

Cross reference fields can be used to identify a message and to provide cross references to other messages. (See Section 3.2.4.)

In-Reply-To (OPTIONAL)

This field designates previous correspondence to which this message is a reply. The usual contents of this field would be the contents of the Message-ID field of the message(s) being replied to.

Message-ID (OPTIONAL)

This field contains a unique identifier for a message. This identifier is intended for machine generation and processing. Further definition appears in Section 3.2.4.1. Only one Message-ID field is permitted in a message.

Obsoletes (OPTIONAL)

This field identifies one or more messages that this one supplants.

Originator-Serial-Number (OPTIONAL)

This field contains one or more serial numbers assigned by the message's originator. Messages with multiple recipients should have the same value in the Originator-Serial-Number field.

References (OPTIONAL)

This field identifies other correspondence that this message references. If the other correspondence contains a Message-ID field, the contents of the References field must be the message identifier.

3.1.7 Message-handling fields

Message-handling fields describe aspects of how a message is to be handled or categorized.

Precedence (OPTIONAL)

This field indicates the precedence at which the message was posted. Ordinarily, message precedence or priority is a service request to a message transfer

system. A message originator, however, can include precedence information in a message. One example of precedence categories are those used by the U.S. Military: "ROUTINE", "PRIORITY", "IMMEDIATE", "FLASH OVERRIDE", and "EMERGENCY COMMAND PRECEDENCE".

Message-Class (OPTIONAL)

This field indicates the purpose of a message. For example, it might contain values indicating that the message is a memorandum or a data-base entry.[1]

Reissue-Type (OPTIONAL)

This field is used in conjunction with message encapsulating (see Section 2.4.1) to differentiate between messages being assigned or redistributed.

Received-From (OPTIONAL)

This field contains a record of a message's path through a message transfer system. The recipient's message receiving program could store here any information about the transfer that it obtained from a message transfer system.

3.1.8 Message-content fields

The intent of most messages is to communicate some particular information from originator to recipient. Several fields in a message are designed to contain that information.

Subject (BASIC)

This field contains any information the originator provided to summarize or indicate the nature of the message.

Text (BASIC)

This field contains the primary content of the message.

Attachments (OPTIONAL)

This field contains additional data accompanying a message. It is similar in intent to enclosures in a conventional mail system.

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[1] The message format specification is not intended to be used as a specification for exchanging data-base records. Messages, however, sometimes contain data from or for a database.

Comments (OPTIONAL)

This field permits adding comments to the message without disturbing the original contents of the message.

Keywords (OPTIONAL)

This field contains keywords or phrases for use in retrieving a message.

3.1.9 Extensions

This message format specification allows two additional types of fields, vendor-defined fields and as-yet-undefined (extension) fields that will be introduced by extensions to this message format specification.

vendor-defined-field
Any field not defined in this message format specification or any extension or successor to it is a vendor-defined field. Names for vendor-defined fields could be preempted by extensions to this message format specification.

extension-field
Any field that is defined in a document published as a formal extension or replacement to this message format specification.

3.2 Message Processing Functions

A CBMS provides three basic classes of functions, creating messages, transmitting messages to their recipient, and post-receipt processing. Although the message format specification does not define the number or nature of user functions in CBMSs, the meanings for the fields clearly assume certain kinds of functions. For example, fields specifying recipients of replies to messages assume some kind of reply function; fields specifying message life span assume some kind of date processing functions.

This section provides more detail on the processing that might be done by these kinds of functions, discussing the message fields that would be used and how they would be used. (See summary in Table 1.)

Processing Function	Fields Involved
Message creation and posting	Author, From, Sender, To, Cc, Bcc
Message reissuing	Reissue-Type
Reply generation	Reply-To
Cross-referencing	Message-ID, In-Reply-To, References, Obsoletes, Originator-Serial-Number
Life span functions	Start-Date, End-Date, Warning-Date
Recipient processing	Circulate-To, Circulate-Next

TABLE 1. FIELDS USED IN MESSAGE PROCESSING FUNCTIONS

3.2.1 Message creation and posting

Messages can be created either by reissuing an existing message to a new recipient (see Section 2.4.1) or by creating a new message. The process of message creation might mean that some fields of a new message are filled in from the contents of some other message. Reply functions (Section 3.2.3) provide an example of this.

Different individuals could be involved in different phases of originating a message: creating it, taking responsibility for it, and explicitly interacting with a CBMS to send it to its recipient. One or more individuals may create (that is, write, but not necessarily enter into the CBMS) a message; they are said to be the message's authors, identified by the Author field. One or more individuals may take responsibility for its contents and the decision to post it; they are identified by the From field. One individual explicitly posts a given message; this person is called the message's sender (identified by the Sender field).

The sender and author(s) are often, but not always, responsible for the message. A common case in which the sender is not responsible for the message is when a secretary enters and posts messages for someone else. An example of a situation in which a message's author is not responsible for the message itself is when an administrative assistant prepares a report that is sent under a manager's signature.

Messages containing Bcc fields are treated specially by CBMSs. The contents of this field are not included in copies of the message sent to the recipients designated in the To and Cc fields. Some systems include the contents of the Bcc field only

in the originator's copy, others include include all or part of the Bcc field in the copies sent to the recipients indicated in the Bcc field. This specification does not mandate how the Bcc field is to be treated.

Audit trail entries (such as the posting time and sender identity) are automatically appended to a message by the CBMS each time the message passes through a posting slot to a message transfer system; a message transfer system could also provide timestamps at each transfer between user agent and the transfer system. A message identifier (Sections 3.2.4 and 3.1.6), placed in the message by the original sender's User Agent, is preserved throughout this message flow. This means that when the same message is sent twice to the same recipients by the same Sender, the audit trail information for the two messages is different.

3.2.2 Message reissuing and forwarding

Reissuing and forwarding both serve the general user goal of passing a message on to a new set of recipients. Forwarding is the term used for an informal mechanism, which CBMSs implement by copying some or all of the original message into the contents of a field in the new message. Reissuing is the term used for a formal mechanism to ensure that the message being passed on never loses its integrity as a previously sent message. CBMSs use reissuing to implement several different functions, depending on the purposes being served.

- Redistribution. Make others aware of the complete and unaltered contents of the message.
- Assignment. Delegate the responsibility for a message to somebody else.

These purposes are exemplified in Figure 2.

When a CBMS examines a forwarded message, it cannot always distinguish the old message from what was added when the forwarding took place. In addition, the forwarded information might no longer have the form of a message. This is usually because the format of the message has been changed (for example, to pure unformatted text). (See Figure 2 for an example of how a CBMS might forward a message.) In contrast, a reissued message can always be separated from its enclosing message and never loses its identity as a correctly formed message.

This specification provides the Reissue-Type field for

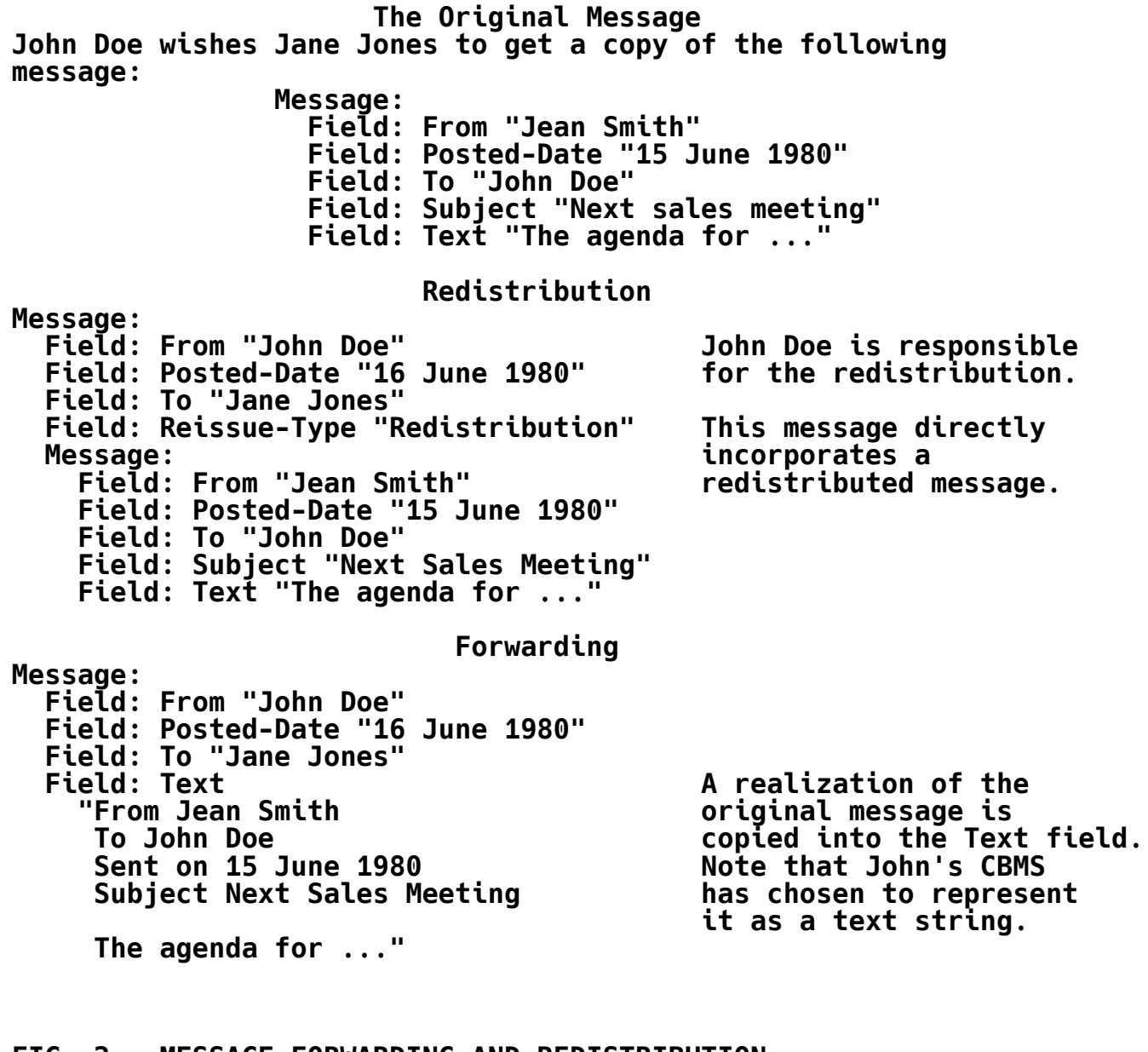


FIG. 2. MESSAGE FORWARDING AND REDISTRIBUTION

supporting re-issuing. Forwarding, since it is an informal means of serving the purpose of passing on information, has no supporting fields in the specification.

This specification provides for reissuing of messages by encapsulating. This method embeds the entire original message inside a new message. Encapsulating adds structure around the message [2]. This allows any part of it to be easily extracted.

Authentication is an organizational policy issue associated passing on previously sent messages. Each organization must decide if the CBMS it acquires should support reissuing or simply supply forwarding.

3.2.2.1 Redistribution

Redistribution is a CBMS function for sending the original contents of a message intact and unchanged to new recipients. A redistributed message is identical to the original message with the exception of added information about the reissuing. For reissuing with this purpose, the Reissue-Type field contains the ASCII string "Redistribution". The original message has been included directly in a new message. (See Figure 2.)

3.2.2.2 Assignment

Assignment is the process of designating responsibility. In some organizations, formal message traffic is funneled through one or more parts of the organization (called offices) where it is directed to the appropriate individuals or other offices for final disposition. Assignment is done by reissuing a message with the Reissue-Type field containing the ASCII string "Assigned." A message which contains this field is to be interpreted as meaning that the addressees in the "To" field have had the reissued message assigned to them for some action. Any addressee in the "Cc" field has had the message assigned for information. The "From" field records who assigned the message and the "Posted-Date" field records when the message was assigned.

---

[2] A message can contain another message, and that message can contain another message, and so on to any depth of encapsulating. This can occur by reissuing a message repeatedly.

3.2.3 Reply generation

Reply generation involves creating a new message in direct reply to some other message by drawing on the contents of fields in the other message to fill fields in the new message. Many CBMSs provide reply facilities that determine the intended recipients of a reply to a message.

- A Reply-To field is defined by this message format specification. When a message contains a Reply-To field, the CBMS should send replies to the recipients designated in the Reply-To field instead of to the recipients designated in the From field. This statement applies to original messages only, not to reissued messages. The message format specification makes no recommendations concerning replies to reissued messages.

  Reply-To has several possible applications.

  1. The individual(s) responsible for the message might not have regular access to a CBMS and would indicate an alternate recipient, for example, a secretary.

  2. The people responsible for receiving responses might not be the people who were responsible for creating the message.

  3. Discussion and conference groups could use this feature to ensure correct distribution of any submission by having the conference group itself designated in the Reply-To field.

- When the message does not contain a Reply-To field, the recipient should reply to the originators enumerated in the From field. The sender and authors should not be added automatically to the list of those receiving the reply.

Replies could also be sent to the other recipients of the original message. Vendors might offer additional reply facilities, depending on their view of users' organizational requirements.

3.2.4 Cross referencing

A CBMS message may include designator(s) which identify other message(s). The designators are used to refer to related messages so that all information in a chain of correspondence can be determined by a CBMS user. The designator used to identify and cross-reference messages can take either of two forms, unique identifiers or serial numbers.

3.2.4.1 Unique identifiers

Unique identifiers are machine-generated quantities that are intended primarily for processing by computers. While they could be examined by a human user, unique identifiers are not necessarily useful or convenient for people.

Unique identifiers occur in several contexts. They are often used to identify the contents of individual messages unambiguously. When unique identifiers are used this way, they are called message identifiers. Different versions of a message (for example, the message when it is reissued with comments) receive new message identifiers.

When a CBMS generates a message identifier, it must be able to guarantee that it is unique, both within the domain of the individual CBMS and globally, across all connected CBMSs. CBMSs could generate globally unique identifiers in several ways, all of which require prior agreement on behalf of the connected CBMSs. One method is to assign each connected CBMS a unique code. A CBMS then generates unique identifiers by using its code as a prefix to some other quantity that it can guarantee to be unique within its domain. (This second quantity could be a counter or a timestamp/user-id combination.)

A CBMS can provide functions for tracing chains of correspondence by using unique identifers. The message format specification defines fields for which a CBMS provides unique identifiers as values. They are Message-ID, References, Obsoletes, and In-Reply-To. (See Section 3.1.6.)

3.2.4.2 Serial numbering

Serial numbers are for users to maintain a personal numbering system for messages. The numbers are composed of both letters and digits so that users could maintain several sets of sequences concurrently (for example, A1, A2, A3... and B1, B2, B3...).

Serial numbers are assigned at a defined point in the history of a message. Serial numbers are not unique identifiers; they differ from unique identifiers (Section 3.2.4.1) in that they are not necessarily either generated or processed by a CBMS. They are designed to be typed and read by CBMS users. They can be as simple or complex as the user requires. Serial numbers are intended to be used to designate messages about a specific topic, or messages a given user has sent. Serial numbers are intended to be a permanent part of the message, just as unique identifiers are.

A CBMS can provide functions allowing originators to add serial numbers to messages. A field has been provided to permit this. Originator-Serial-Number is for an originator to add a serial number to a message before sending it.

3.2.5 Life span functions

Messages have life spans, usually delimited by the creation date and the time when the last copy of the message is destroyed. Messages could be meaningless before a certain time or irrelevant after a certain time. For example, a reminder to attend a meeting on 5 June loses most of its value on the sixth; a reminder to attend that same meeting is likely to be of little use on 5 May (although not for the same reason).

A CBMS can define a message's life span explicitly using the Start-Date and End-Date fields. A third field, Warning-Date, when used in conjunction with the End-Date, may be used to signal the approach of the End-Date. It may also stand alone and be used by a periodic warning (alarm clock) mechanism.

A CBMS could use these fields to help users manage their message stores. For example, a message whose start date has not yet passed could be bypassed by a retrieval command unless the user requested such messages explicitly. A CBMS could use the end date to help with message store housekeeping either by archiving or deleting the expired messages automatically or by asking the user for some action to be taken on them. The warning date could be used to automatically remind the user of an impending end date, such as a meeting reminder.

3.2.6 Requests for recipient processing

Recipients have a wide variety of needs for examining and processing a message, ranging from automatic output on some specified device to the execution of a program embedded in the

message itself. Because many of these needs are highly specialized, and support for them not widely implemented, this message format specification does not constrain the requests for processing that may be included in a message.

The message format specification does provide two fields that permit an originator to request circulation list processing from the recipient. These fields are Circulate-To and Circulate-Next.

3.2.6.1 Message circulation

Message circulation involves serial distribution of a message to its recipients, based on a distribution list that is part of the message. The message is delivered first to the first recipient on the distribution list. This recipient, or someone the recipient delegates, sends the message on to the second recipient on the list, perhaps after commenting on or adding to the message. This continues until all recipients on the distribution list have received the message.

This message format specification provides two fields to support message circulation. The Circulate-To field contains the complete distribution list, indicating the full set of recipients, and the Circulate-Next field indicates which recipients have not seen the message. See Figure 3 for an example of message circulation using these two fields.

3.3 Multiple Occurrences and Ordering of Fields

Most message fields may occur more than once in a message; the exceptions are the Posted-Date, Sender, and Message-ID fields, which may occur at most once. What this means is that a received message may contain any number of instances of a particular field (such as the "To" field). If a message contains more than one instance of a particular field, that field "occurs multiply" and that message has "multiple occurrences" of that field.

A particular instance of a message field is not superseded by later instances of the same field. The To field is an example of this.

Multiple occurrences of a field are not necessarily equivalent to a single field containing the concatenated contents of the several instances of the given field. For example, with the Text field, concatenating the contents of several instances

---

A message originator wishes to circulate a message to recipients A, B and C. The originator includes the following fields in the message:

```
To:              A
Circulate-To:    A, B, C
Circulate-Next:  B, C
```

When recipient A or somebody A delegates causes the message to be further circulated, the message is sent to the first address in the Circulate-Next field, and that name is removed from that field:

```
To:              B
Circulate-To:    A, B, C
Circulate-Next:  C
```

B now sends the message on to its final recipient:

```
To:              C
Circulate-To:    A, B, C
```

FIG. 3. EXAMPLE OF MESSAGE CIRCULATION

---

might lose important distinctions between the contents. A single message could be used to send three different documents, each one in a different Text field. However, putting the three documents into a single Text field would make it much more difficult to extract any individual document.

The fields found in a single message may occur in any order. The order in which they occur does not necessarily reflect the order in which they were created. Nor does it constrain the order in which the message recipient examines, processes, or displays them.

4. SYNTAX

This section begins with an introduction to the concepts and elements that constitute the syntax for messages. The second section presents an overview of the encoding scheme. The third section describes in detail the elements of the message syntax.

4.1 Introduction

This specification defines syntactic requirements for messages when they are passed from one CBMS to another. The specification is designed to meet the following goals.

- Provide a concise flexible representation scheme.
- Simplify message parsing.
- Support non-textual components in messages (for example, facsimile, graphics, or speech[3]).

4.1.1 Message structure

Messages have two classes of components, fields and messages. A field corresponds to one of the semantic components defined in this message format specification. A message is simply another message.

The type of a field in a message determines both its meaning and the form for its contents. (See Section 4.3.2.)

Fields in a message are composed of syntactic elements called data elements. A Message data element is used to represent messages; a Field data element is used to represent fields. (The term "field" is simply a semantic construct, distinct from "Field Data Element", which is a syntactic

---

[3] While this message format specification is not intended to be used as a basis for the intnge of all facsimile information, it does recognize that CBMS messages may contain facsimile components.

construct.) Many of the fields defined in this message format specification estricted to containing only one kind of data element. (See Section 4.3.2.)

Each field defined in this message format specification has been assigned a unique numeric identifier that is used in conjunction with the Field data element. Separate identifiers are provided for vendor-defined fields and for extending the identifier encoding space. A list of fields and identifiers appears in Section 4.3.2 and in Appendix C.

Throughout the message format specification, fields are referred to by label name rather than by their numeric identifiers. Field labels are names like "Sender", "Warning-Date", or "Circulate-To". The field labels chosen for the specification are names that are in common use in current CBMSs. The specification does not require a CBMS to use these field labels in displaying fields to the user, although such usage is encouraged to provide a common user interface.

4.1.2 Data elements

For the purpose of determining compliance with the syntax defined in this specification, data elements are divided into two groups, basic and optional.

BASIC All message receiving systems must process these syntactic elements, interpreting their values according to the message format specification.

OPTIONAL Message receiving systems need not process these syntactic elements in order to be in compliance.

In addition, complying CBMSs must meet requirements regarding their ability to process the components found inside data elements. These requirements are discussed in Section 4.2.2. (Semantic compliance is defined in Section 3.1.2.)

This message format specification classifies data element types as either primitives or constructors. (See Sections 4.1.2.1 and 4.1.2.2.) Primitive data elements, such as ASCII-String, are basic building blocks. Constructor data elements, such as Message or Sequence, contain one or more primitive or constructor data elements. Some constructors, such as Sequence, may be composed of any other data element. Some, such as Message, may contain only certain data elements. (See Section 4.3.1.)

4.1.2.1 Primitive data elements

A primitive data element contains a basic item of information; it is not composed of other data elements. In current CBMSs, the most commonly used primitive data element is ASCII-String, a series of ASCII characters. Other primitive data elements are Integer, 2's complement integers; Bit-String, a series of bits; and Boolean, either True or False.

One primitive data element, End-Of-Constructor, is used only as a structural element within constructor data elements and has no meaning by itself. End-of-Constructor is used to provide an end marker for constructor data elements that do not have an explicit length. (See Section 4.2.2.1.) Any other use is not valid syntactically.

4.1.2.2 Constructor data elements

The Data Element Contents of constructor data elements contain one or more data elements. The most general form of a constructor is a Sequence or a Set, since both Sequences and Sets may contain any data element. Other constructors are specialized forms of sequences.

A Message data element is a constructor. It may contain only Field data elements, other Message data elements, or encrypted or data compressed forms of these elements. A Field data element can contain any data element. It also indicates which specific field is being represented. The contents of some fields are restricted to a single type of data element, such as ASCII-String or Date.

4.1.3 Properties

Any data element may have associated with it a Property-List, which contains properties such as a Printing-Name (Section 4.1.3.1) or one or more Comments (Section 4.1.3.2). A mechanism to support vendor-defined properties has been supplied by this specification, as well as a mechanism to extend the list of property identifiers.

4.1.3.1 Printing-names

Printing-Names are used to provide labels that can be displayed along with their respective data elements. For example, a message originator may use a Printing-Name property to request that the To field of a message be labeled "Distribution:" when it is printed by its recipients.

4.1.3.2 Comments

The Comment property is used to allow comments to be associated with any data element without affecting its actual contents. For example, someone reviewing the text of a message could add the comment "This looks good" to the Text field without either altering the body itself or adding a separate comment field.

4.1.4 Data compression and encryption

Two constructor data elements, Compressed and Encrypted, have been provided for use by a CBMS that supports data compression or encryption. They may be used to hold the compressed or encrypted contents of any data element, including Messages and Fields, and may occur wherever their compressed or encrypted contents may appear. A mechanism is included to allow the user to identify the encryption or compression algorithm used (Sections 4.3.4 and 4.3.5).

4.1.5 Data sharing

Data sharing is the multiple use of a data element via references to a single copy. It is used in two situations.

- For economy when a large object appears more than once in a message. Data sharing may be used in this situation to economize on storage and transmission costs.
- For consistency when the same object appears more than once in a message. If one instance of that object is altered, all instances must reflect this alteration. In this case several copies of the same object will not serve the purpose as well as data sharing.

While there is a demonstrable need for facilities to support data sharing, this specification does not define such a mechanism. At this time there is insufficient experience with data sharing in messages to allow standardization. The specification is sufficiently flexible however to allow extensions to the syntax for supporting data sharing at a later time.

4.2 Overview of Syntax Encoding

This section provides an overview of the notation and terminology used to represent the syntactic elements (data elements) defined in this message format specification.

All data elements consist of a series of components. Each of the components is composed of a series of 8-bit groups called octets. In this document, the bits are numbered starting from the low-order bit. That is, the low-order (or least significant) bit is called "bit 0" and the high-order (or most significant) bit is called "bit 7".

Five different components may appear in a data element.

- Identifier octet (identifying particular type of data element)
- Length Code (specifying number of octets that appear following it in a data element)
- Qualifier (supplying additional identifying information)
- Property-List component (a Property-List data element containing Property data elements)
- Data Element Contents (containing actual data of the data element)

These components always appear in this order. Not all components are present in all data elements but the components that are present maintain this relative order.

4.2.1 Identifier Octets

The identifier octet is a numeric code containing information that identifies a data element. It is always the first component in a data element. The Identifier octet contains a one-bit flag, indicating whether or not the data element contains a Property-List, and a seven-bit unique identifier for the data element. The value of the data element identifier also indicates whether the data element has a Qualifier. (See Table 2.)

Bit	Value	Meaning
7	0	The data element does not have properties associated.
	1	The data element has properties associated.
6	0	The data element does not have a Qualifier.
	1	The data element has a Qualifier.

TABLE 2. TYPE BITS IN THE IDENTIFIER OCTET

The most significant bit (Bit 7) of the identifier octet is set to 1 if there are properties associated with the data element; it is set to 0 if there are none. This bit is independent of the remaining seven bits in the identifier octet, which are called the identifier, and provide unique identification for data elements. The associated properties are specified in a Property-List component.

The second most significant bit (Bit 6) of the identifier octet (the most significant bit of the identifier itself) signifies whether or not the data element has a Qualifier. If the bit is set to 1, then the data element has a Qualifier; if it is a 0, the data element does not have a Qualifier. The seven bits of the identifier uniquely identify the data element. (See Figure 4.)

Data elements all have a Length Code component immediately following the identifier octet. (See 4.2.2.1.)

4.2.2 Length code and Qualifier components

The Length Code and the Qualifier are both usually one octet in length. They use an encoding scheme that permits extending the component to the size necessary to represent the length of the data element or the value of the Qualifier component.

The most significant bit of the Length Code or Qualifier components determines whether it is one or several octets in length. When the most significant bit is 0, the component is one

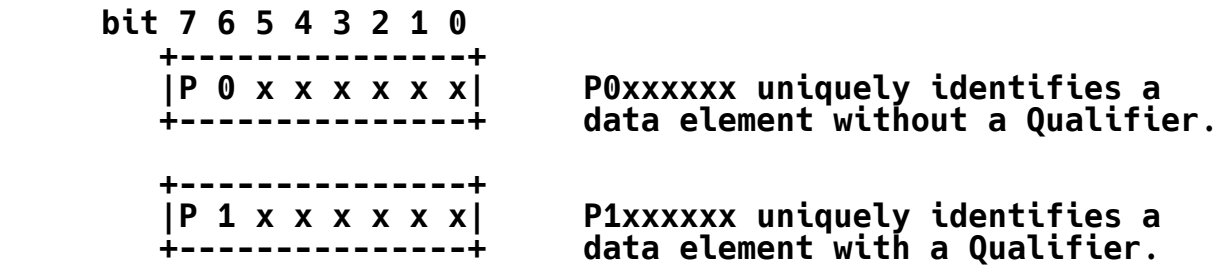


FIG. 4. STRUCTURE OF IDENTIFIER OCTETS

octet in length. When the most significant bit is 1, the other seven bits of the first octet encode the number of octets in the rest of the component. The actual value begins in the next octet and is interpreted as an unsigned integer.

A single octet is sufficient for most Length Code and Qualifier components. For those cases where the value of the Length Code or the Qualifier must be greater than 127, extra octets can be added, up to a maximum of 127 octets. Figure 5 shows the encoding scheme, as well as an example of a value less than 127 and one greater than 127.

In order to comply with this message format specification, CBMSs must be able to determine the value of any length code or qualifier that is expressed in three octets or less. (The

$2^{16}-1$. This message format specification places no limitation on the value of a length code or qualifier generated by a CBMS (except for the absolute limitation inherent in the representation scheme). However, the use of length codes and

$2^{32}-1$ should be avoided unless it is known that the receiving system can handle them.

Both Length Codes and Qualifiers have a special convention for dealing with special situations. Length Codes can specify that a data element had indeterminate length; a Qualifier can specify that a data element is implementation defined. These cases are explained further in Sections 4.2.2.1 and 4.2.2.2.

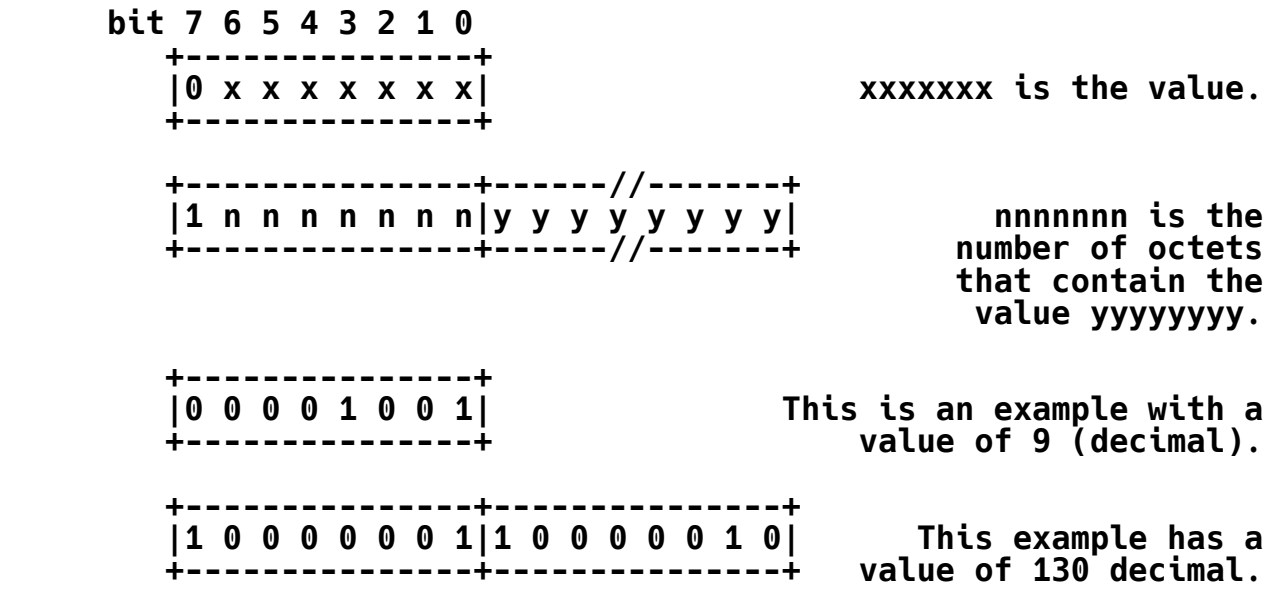


FIG. 5. ENCODING MECHANISM FOR QUALIFIERS AND LENGTH CODES

4.2.2.1 Length Codes

The Length Code indicates the number of octets following it in a data element (that is, excluding the identifier octet and the length code itself). Length Codes appear in one of three formats, short, long, and indefinite.

A short Length Code is one octet long. Its most significant bit (Bit 7) is set to 0 and its value is in the range 0 through 127.

A long Length Code is at least two octets long. The first octet always has its most significant bit (Bit 7) set to 1. The other seven bits of this octet contain the number of octets making up the rest of the Length Code and these octets contain

$$(2^{1016} - 1)$$

(that is, 127 octets to represent the value).

An indefinite Length Code is one octet long. Its most significant bit (Bit 7) is set to 1 and its other bits are all 0. (See Figure 6.) An indefinite Length Code may appear only as

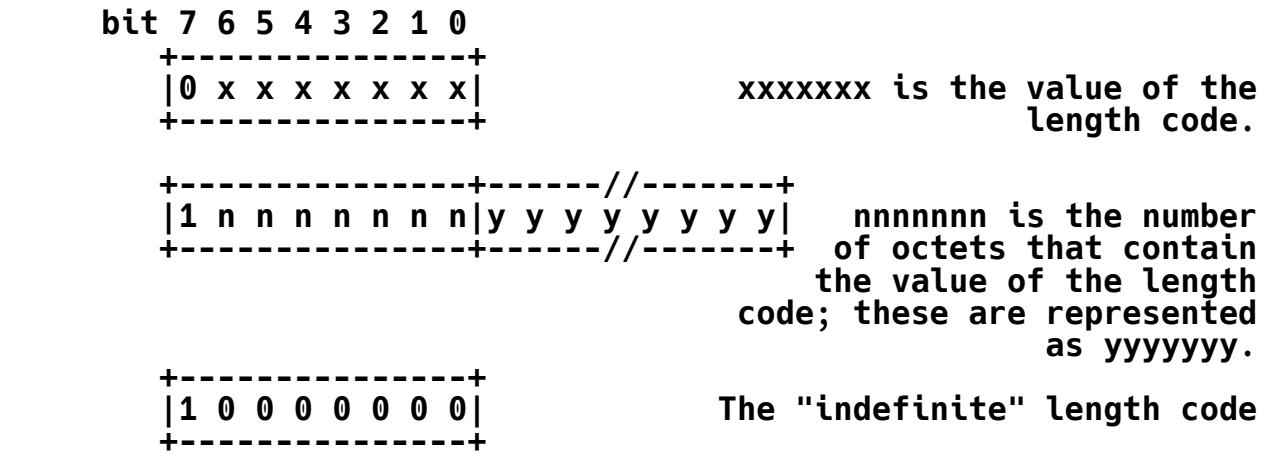


FIG. 6. REPRESENTATION OF LENGTH CODES

part of a constructor data element; it may not occur in a primitive data element[4]. A constructor data element with an indefinite length code has an End-Of-Constructor data element as the last data element in its Data Element Contents. (The length of such a constructor data element is unrestricted although it must contain at least one data element -- the End-of-Constructor that terminates it -- in its Data Element Contents.)

Figure 7 shows the Length Codes for three elements; their values are 38, 201, and 300.

4.2.2.2 Qualifier

The Qualifier component of a data element is used to provide information essential to the interpretation of the data element contents that is beyond that encoded in the identifier octet or length code. For example, the identifier octet could contain the

---

[4] This is the result of most primitive elements being able to contain any bit pattern (including the identifier for End-Of-Constructor).

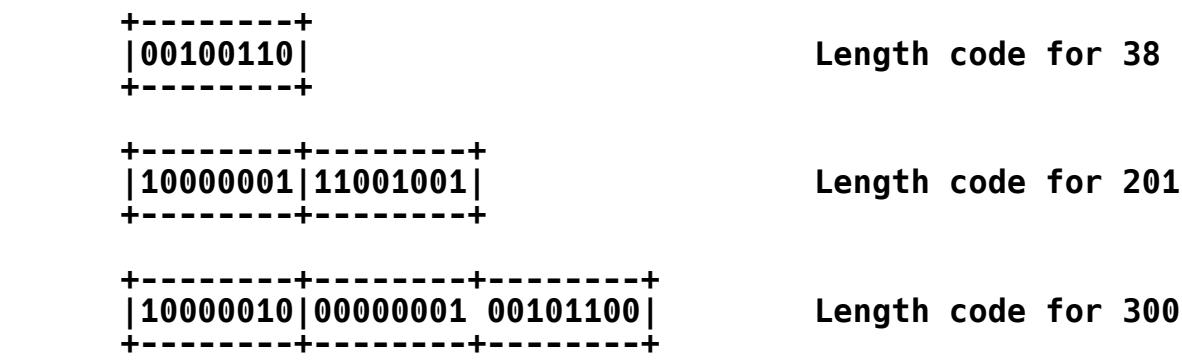


FIG. 7. EXAMPLES OF LENGTH CODES

code for a field and the Qualifier component would specify what kind of field.

The Qualifier component appears in only a few data elements. In the Bit-String data element, it indicates the number of unused bits in the final octet of the Data Element Contents. In the Field and Property data elements, it indicates which field or property the data element represents. In the Compressed and Encrypted data elements, it indicates which compression or encryption algorithm has been used. In the Message data element, it indicates the type of message.

In the sequence of data element components, the Qualifier occurs between the Length Code and the Property-List components. The length of the Qualifier component depends on the encoding of the Qualifier. (See Figure 8.) A short Qualifier is one octet long. Its most significant bit is 0 and its value is in the range 0 through 127. A long Qualifier is at least two octets in length. The most significant bit is always 1 and the other 7 bits indicate the number of octets in the value of the Qualifier.

This message format specification allows implementations to define their own values for Qualifiers. A vendor-defined Qualifier is any long Qualifier in which the first octet in the value is 0. The value used to identify this Qualifier is not guaranteed to be unique and the same value may be used by different implementations to define different Qualifiers.

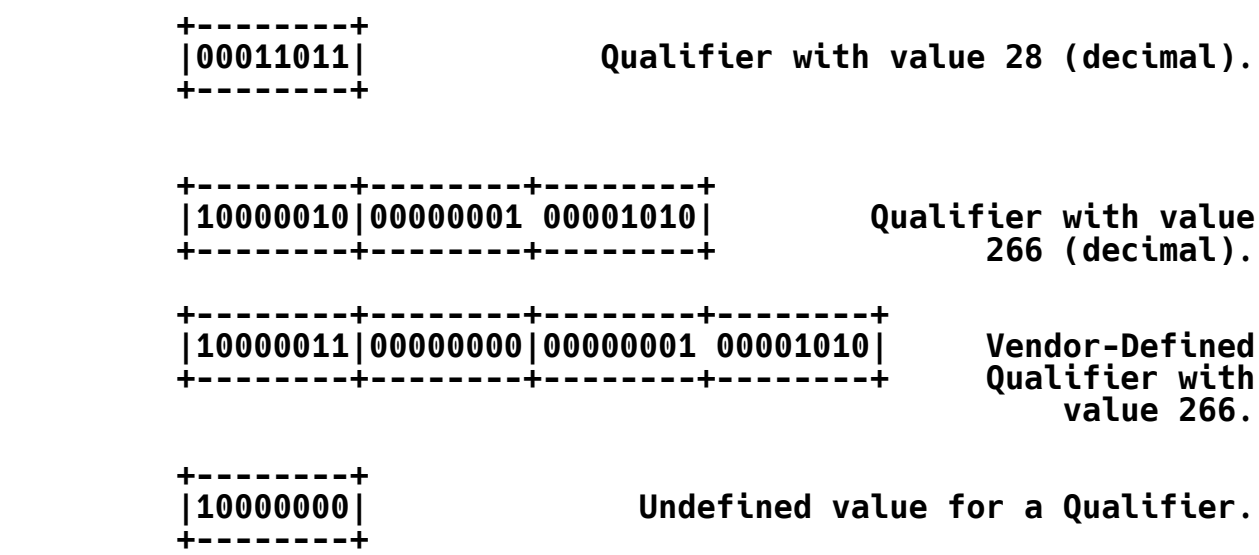


FIG. 8. EXAMPLES OF QUALIFIER VALUES

4.2.3 Property-List

A Property is an attribute being associated with a data element. The properties currently defined by this message format specification are Printing-Name and Comment. A Property-List component of a data element is represented by a Property-List data element that in turn contains Property data elements.

A data element contains at most one Property-List. The most significant bit in the identifier octet of the data element indicates whether a Property-List is present. (See Section 4.2.1.)

4.2.4 Data Element Contents

The Data Element Contents component of a data element is the actual data or information represented by a data element. (The other components provide the information necessary to identify and interpret the Data Element Contents.)

In a primitive data element, the Data Element Contents is a series of octets interpreted according to the identifier octet and any qualifier.

In a constructor data element, the Data Element Contents is a series of data elements. When the Length Code component of a constructor data element is "indefinite", the last data element in the constructor's Data Element Contents is End-of-Constructor.

The length of the Data Element Contents (in octets) is the difference between the value of the Length Code and the sum of the following:

- the length of the Qualifier component (depends on the data element)
- the length of the Property-List component

4.3 Data Element Syntax

This message format specification defines nineteen (19) different data elements. Section 4.3.1 defines the encoding form for data elements in general and the syntax for each data element. Section 4.3.2 describes the use of specific data elements as part of the Data Element Contents of a Field data element. A summary of the syntactic form appears in Appendix F; summaries of the data element syntax appear in Appendix G.

4.3.1 Data elements

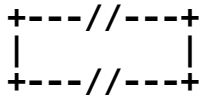
This section presents the general syntactic form for all data elements defined by this message format specification and the detailed syntax for each data element. The data elements are presented by syntactic class: primitive data elements (Section 4.3.1.1), and constructors (Section 4.3.1.2).

For convenience, the following terminology is used in this section.

Term	Meaning
Primitive	a Primitive Data Element
Constructor	a Constructor Data Element
Element	any Data Element

The syntax of each Element is presented in graphic form. The following conventions apply in the diagrams. A single octet is represented as follows.

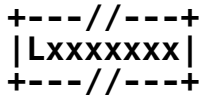
Components that vary in length are represented as follows.



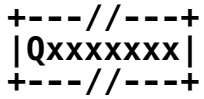
Each Element has up to five components: an Identifier, a Length Code, a Qualifier, a Property-List and the Data Element Contents. (See Section 4.2.)

In the diagrams, the contents of the identifier octet is shown as a "P" followed by an identifier represented in binary. (See Figure 4.) The identifier itself is a seven bit quantity, right justified in the identifier octet. Full details on identifier octets appear in Section 4.2.1.

A length code is always represented in the following manner:



A qualifier is always represented in the following manner:



A Property-List (if present) always immediately precedes any occurrence of Data Element Contents.

The Data Element Contents appears in diagrams as one of the following.

- "element(s)", which may be any data element(s)
- "anything", which is undefined and may be any combination of bits
- a specific data element
- the interpretation to be applied to the bits within the octets that constitute the element (such as ASCII or Integer)

Two data elements have been reserved for special purposes. The Extension data element is provided to allow for future expansion of the possible data elements. The Vendor-Defined data element allows CBMS vendors to define their own data elements. Vendor-Defined data elements are not guaranteed to be unique, since two implementations could define different data elements using the same identifier. Vendor-Defined data elements should be used and interpreted by prior agreement.

In the following sections, each element is presented with its name, compliance classification (BASIC or OPTIONAL), its identifier (both in hexadecimal and in octal), a brief description of its use, and a graphic representation. Each data element description has the following form.

```
-----------------------------------------------------------------
Data Element              (Compliance)   identifier   identifier
    Name                  ( Category )    octet         octet
                                               16           8

              Description of the syntax of the data element.


            +---//---+
            |        |     Diagram representing data element
            +---//---+



-----------------------------------------------------------------
```

4.3.1.1 Primitives

The data elements in this section are arranged in alphabetical order by name. (Appendix C presents the identifiers in numeric order.)

```
ASCII-String              (BASIC)        02        002
                                           16         8
```

This data element contains a series of ASCII characters, each character right-justified in one octet. For seven-bit ASCII characters, the most significant bit of each octet must be 0.

```
 +--------+---//---+----//-----+
 |P0000010|Lxxxxxxx|ASCII chars|
 +--------+---//---+----//-----+
```

Bit-String (OPTIONAL) 43 (16) 103 (8)

This data element contains a series of bits. It uses the Qualifier data element component to record the number of bits of padding (as an eight bit unsigned integer) needed to fill the final octet of the Data Element Contents to an even octet boundary. These padding bits have no meaning and occur in the low order bits of the final octet. The valid values for the Qualifier component are 0 through 7. The number of bits in the Data Element Contents is calculated from the following formula.

8 * number of octets in the Data Element Contents - value of Qualifier component

Boolean (OPTIONAL) 08 (16) 010 (8)

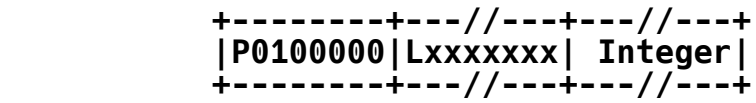
This data element contains one octet whose value is either true or false. False is represented by all bits being 0; true is represented by all bits being 1 (although any non-zero value should be interpreted as true).

End-of-Constructor (BASIC) 01 (16) 001 (8)

This data element terminates the Data Element Contents in a constructor data element that has indefinite length. This data element has no Contents component. (Use of this element is described in Section 4.2.2.1.)

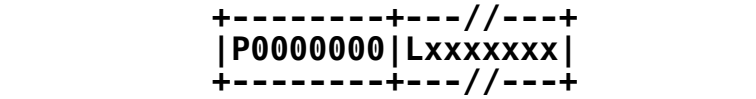
Integer (OPTIONAL) 20 040
16 8

This data element contains a 2's complement integer of variable length, high order octet first. It is recommended that the data element contents be either 2 or 4 octets long whenever possible.



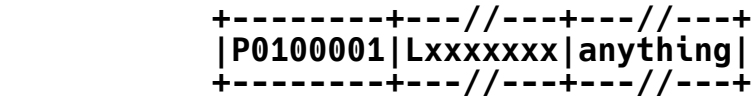
No-Op (OPTIONAL) 00 000
16 8

This data element does nothing. No-Op is used whenever it is necessary to include a data element that means "no operation". It is a short placeholder.



Padding (OPTIONAL) 21 041
16 8

This data element is used to fill any number of octets. The contents of a Padding element are undefined and convey no information.

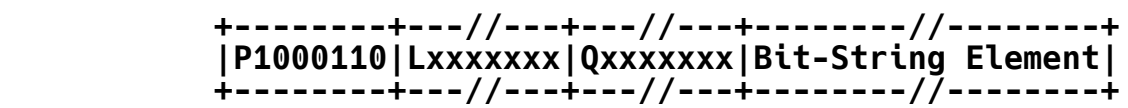


4.3.1.2 Constructors

The data elements in this section are arranged in alphabetical order.

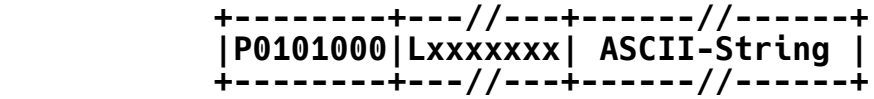
Compressed (OPTIONAL) 46 106
16 8

This data element must contain a Bit-String data element. It is used to represent any data that has been compressed; it may be used wherever its uncompressed contents may appear. A Qualifier data component appears in each Compressed data element; it contains a compression identifier (CID) to identify the compression algorithm used. (See Section 4.3.5.) The Data Element Contents contains the product of the compression process.



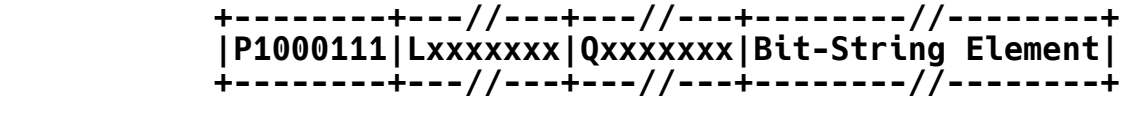
Date (BASIC) 28 050
16 8

This data element contains an ASCII-String data element, which is a representation of a date and time formatted in accordance with PUBS 4 [NatB-68], 58 [NatB-79a] and 59 [NatB-79b].



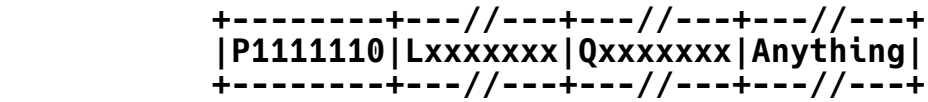
Encrypted (OPTIONAL) 47 107
16 8

This data element must contain a Bit-String. It is used to represent any data that has been encrypted; it may be used wherever its unencrypted contents may appear. A Qualifier data component appears in each Encrypted data element; it contains an encryption identifier (EID) identifying the encryption algorithm used. (See Section 4.3.4.) The Data Element Contents is the product of the encryption process.



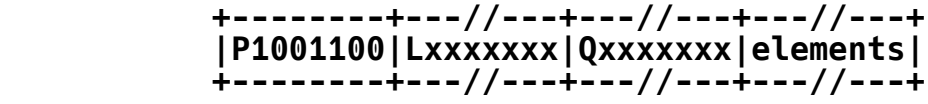
Extension (OPTIONAL) 7E 176
16 8

This data element is used to extend the number of available data elements beyond the 128 that are possible using a 7-bit identifier. A Qualifier component extends the encoding space for identifiers. (Extension and Vendor-Defined have the same syntax.)



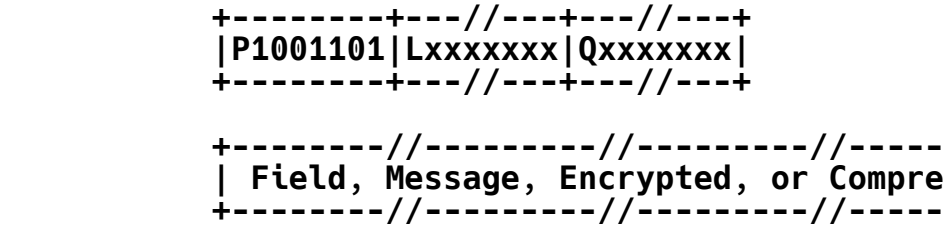
Field (BASIC) 4C 114
16 8

This data element uses a Qualifier data element component. The Qualifier component contains a Field Identifier (FID) indicating which specific field is being represented. (See Section 4.3.2.)



Message (BASIC) 4D 115
16 8

This data element may contain Field or Message data elements. Its Qualifier component contains a Message type (MID) indicating the type of the message. (See Section 4.3.6.) (The MID is completely different from the message identifier in the Message-ID field and should not be confused with it.)



Property-List (OPTIONAL) 24 (16) 044 (8)

This data element contains a series of Property data elements to be associated another data element.

```
+--------+---//---+-------//--------+
|P0100100|Lxxxxxxx|Property Elements|
+--------+---//---+-------//--------+
```

Property (OPTIONAL) 45 (16) 105 (8)

This data element uses a Quali data element component. The Qualifier component contains a Property-Identifier (PID) to indicate which specific property is being represented. (See Section 4.3.3.)

```
+--------+---//---+---//---+---//---+
|P1000101|Lxxxxxxx|Qxxxxxxx|elements|
+--------+---//---+---//---+---//---+
```

Sequence (OPTIONAL) 0A (16) 012 (8)

This data element contains any series of data elements. Sequence differs from Set in that the data elements making up the Data Element Contents must be considered as an ordered sequence (according to their order of appearance in the sequence.)

```
+--------+---//---+---//---+
|P0001010|Lxxxxxxx|elements|
+--------+---//---+---//---+
```

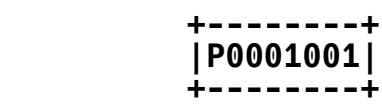
Set (OPTIONAL) 0B (16) 013 (8)

This data element contains any series of data elements with no ordering of the elements implied. (Sequence provides an ordered series.) Although the data elements contained in a Set must be stored sequentially, the order in which they are stored is not defined and not processed.

```
+--------+---//---+---//---+
|P0001011|Lxxxxxxx|elements|
+--------+---//---+---//---+
```

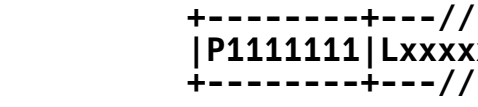
Unique-ID (OPTIONAL) 09 (16) 011 (8)

This data element is a unique identifier. It need not be human-readable. The Data Element Contents may be an ASCII-String, a Bit-String, or an Integer.



Vendor-Defined (OPTIONAL) 7F (16) 177 (8)

This data element is used to represent vendor- and user-defined data elements. A Qualifier component extends the encoding space for identifiers. The Qualifier component is not guaranteed to be unique among all interconnected systems. This data element is interpreted according to prior agreement between systems. (Extension and Vendor-Defined data elements have the same syntax.)



4.3.2 Using data elements within message fields

The Data Element Contents of a particular field in a message must contain at least one data element. The types of data elements that can appear in the Data Element Contents of a field are restricted according to what kind of field it is. Appendix A (the master reference appendix for fields) nes which data elements are valid as the Contents for each of the fields.

Some fields have a Data Element Contents that contains "originators" or "recipients." No data element represents the identities of originators or recipients (because that encoding is not within the scope of this message format specification.) These descriptions simply list "originators" or "recipients", implying no restrictions on how the identifiers for originators or recipients are represented.

4.3.3 Properties and associated elements

This message format specification defines two properties.

Comment 01 001
16 8

This property may contain any series of data elements; it most commonly contains one or more ASCII-Strings.

Printing-Name 02 002
16 8

This property contains one ASCII-String. In this case, the ASCII-String may contain only the printing ASCII characters plus the "space" character.

4.3.4 Encryption identifiers

This message format specification defines two encryption identification codes.

Unspecified 00 000
16 8

Use of this encryption identifier as part of the Encrypted data element indicates that the encryption method being used was not specified for inclusion as part of the data element.

NBS-Standard 01 001
16 8

Use of this encryption identifier as part of the Encrypted data element indicates that the NBS standard method for data encryption [NatB-77] was used.

4.3.5 Compression identifiers

This message format specification defines two compression identification codes for use with the Compressed data element.

Unspecified 00 000
16 8

Use of this compression identifier as part of the Compressed data element indicates that the compression method being used was not specified for inclusion as part of the data element.

NBS-Standard 01 001
16 8

Use of this compression identifier as part of the Compressed data element is reserved at the present time. It will be used in the future to indicate that the NBS standard method for data compression was used once the data compression standard is defined.

4.3.6 Message types

This message format specification defines message type (MID) codes for use in classifying the type of a message. The message type could be confused with the message identifier in the Message-Id field; they are completely distinct concepts.

NBS-Standard 01 01
16 8

This message type marks messages defined by this message format specification.

SUMMARY OF APPENDIXES

Appendix A Defines the fields in the message format specification. This alphabetical appendix is for reference use by implementors. It contains semantic definitions of fields from Section 3.1. It also defines Field Identifier values and specifies which data elements are valid as the Contents for each of the fields.

Appendix B Defines the data elements in the message format specification. This alphabetically ordered appendix is for reference use by implementors. It consolidates information from Section 4.3.

Appendix C Provides a reference table listing the data elements in numerical order by their identifier octets.

Appendix D Provides a reference table summarizing the components of messages according to whether they are required or otional for CBMSs implementing the specification.

Appendix E Provides a reference table organizing the message components according to the functional class of the components.

Appendix F Provides an overview of the syntactic elements defined by this message format specification.

Appendix G Summarizes syntactic elements according to whether they are required or optional for a CBMS implementing the message format specification.

Appendix H Examples of each syntactic element displaying their syntax and describing their associated semantics.

APPENDIX A
FIELDS -- IMPLEMENTORS' MASTER REFERENCE

This appendix defines all of the fields in the message format specification for reference use by implementors. It contains semantics definitions of fields from Section 3.1. It also defines Field Identifier values and which data elements are valid as the Contents for each of the fields. The field definitions appear alphabetically.

Each field in the list has the following form:

```
-----------------------------------------------------------------
Field Name              Compliance   identifier  identifier
                                       value       value
                                            16          8

          Description of the field semantics.   Names  of
       data  elements  that  are  valid in the Data Element
       Contents of this kind of field.

-----------------------------------------------------------------
```

Attachments — OPTIONAL — identifier value 08 (16) — identifier value 010 (8)

This field contains additional data accompanying a message. It is similar in intent to enclosures in a conventional mail system. Contents of this field are unrestricted.

Author — OPTIONAL — identifier value 0C (16) — identifier value 014 (8)

This field identifies the individual(s) who wrote the primary contents of the message. Use of the Author field is discouraged when the contents of the Author field and the From field would be completely redundant. This field contains one or more originator identities.

Bcc — OPTIONAL — identifier value 0D (16) — identifier value 015 (8)

This field identifies additional recipients for a message (a "blind carbon copies list"). The contents of this field are not to be included in copies of the message sent to the primary and secondary recipients. See section 3.2.1 for further discussion of the use of blind carbon copies lists. This field contains one or more recipient identities.

Cc BASIC 06 006
16 8

This field identifies secondary recipients for a message (a "carbon copies" list). This field contains one or more recipient identities.

Circulate-Next OPTIONAL 0E 016
16 8

This field is used in conjunction with the Circulate-To field. (See Section 3.2.6.1.) It identifies all recipients in a circulation list who have not yet received the message. This field contains one or more recipient identities.

Circulate-To OPTIONAL 0F 017
16 8

This field identifies recipients for a circulated message. (See Section 3.2.6.1.) It is used in conjunction with the Circulate-Next field. This field contains one or more recipient identities.

Comments OPTIONAL 10 020
16 8

This field permits adding comments onto the message without disturbing the original contents of the message. While the Comments field will usually contain one or more ASCII-Strings, there are no restrictions on its contents.

Date OPTIONAL 11 021
16 8

This field contains a date that the message's originator wishes to associate with a message. The Date field is to the Posted-Date field as the date on a letter is to the postmark added by the post office. This field contains one Date.

End-Date OPTIONAL 12 022
16 8

This field contains the date on which a message loses effect. (See also Section 3.2.5.) This field contains one Date.

From REQUIRED 01 001
16 8

This field contains the identity of the originators taking formal responsibility for this message. The contents of the From field is to be used for replies when no Reply-to field appears in a message. This field contains one or more originator identities.

In-Reply-To OPTIONAL 13 023
16 8

This field designates previous correspondence to which this message is a reply. The usual contents of this field would be the contents of the Message-ID field of the message(s) being replied to. This field contains one or more Unique-IDs or ASCII-Strings.

Keywords OPTIONAL 14 024
16 8

This field contains keywords or phrases for use in retrieving a message. This field contains one or more ASCII-Strings. (Each keyword or phrase is represented by a separate ASCII-String.)

Message-Class OPTIONAL 15 025
16 8

This field indicates the purpose of a message. For example, it might contain values indicating that the message is a memorandum or a data-base entry. This field contains one data element, an ASCII-String.

Message-ID OPTIONAL 16 026
16 8

This field contains a unique identifier for a message. This identifier is intended for machine generation and processing. Further definition appears in Section 3.2.4.1. Only one Message-ID field is permitted in a message. This field contains one data element, a Unique-ID.

Obsoletes OPTIONAL 26 046
16 8

This field identifies one or more messages that this one supplants. This field contains at least one Unique-ID and may contain more than one.

Originator-Serial-Number OPTIONAL 17 027
16 8

This field contains one or more serial numbers assigned by the message's originator. (Messages with multiple recipients should all have the same value in the Originator-Serial-Number field. This field contains one or more ASCII-Strings. (One ASCII-String is used for each serial number.)

Posted-Date REQUIRED 02 002
16 8

This field contains the posting date, which is the point in time when the message passes through the posting slot into a message transfer system. Only one Posted-Date field is permitted in a message. This field contains one Date.

Precedence OPTIONAL 18 030
16 8

Ordinarily, message precedence or priority is a service request to a message transfer system. A message originator, however, can include precedence information in a message. This field indicates the precedence at which the message was posted. One example of a precedence scheme is the US Military categories "ROUTINE", "PRIORITY", "IMMEDIATE", "FLASH OVERRIDE", and "EMERGENCY COMMAND PRECEDENCE". This field contains one ASCII-String.

Received-Date OPTIONAL 19 031
16 8

Delivery date. This field may be added to a message by the recipient's message receiving program. It indicates when the message left the delivery system and entered the recipient's message processing domain. This field contains one Date.

Received-From OPTIONAL 1A 032
16 8

This field contains a record of a message's path through a message transfer system. The recipient's message receiving program may store any such information that it obtains from a message transfer system in this field. The contents of this field are unrestricted.

References OPTIONAL 20 040
16 8

This field identifies other correspondence that this message references. If the other correspondence contains a Message-ID field, the contents of the References field must be the message identifier. This field contains one or more Unique-IDs or ASCII-Strings.

Reissue-Type OPTIONAL 25 045
16 8

This field is used in conjunction with message encapsulating (see Section 3.2.2) to differentiate between messages being assigned or redistributed. This field contains one data element, usually an ASCII-String.

Reply-To BASIC 03 003
16 8

This field identifies any recipients for replies to the message. This field contains one or more recipient identities.

Sender OPTIONAL 22 042
16 8

This field identifies the agent who sent the message. It is intended either for when the sender is not the originator responsible for the message or to indicate who among a group of originators responsible for the message actually sent it. Use of the Sender field is discouraged when the contents of the Sender field and From field would be completely redundant. Only one Sender field is permitted in a message. This field contains one originator identity.

Start-Date OPTIONAL 23 043
16 8

This field contains the date on which a message takes effect. (See also Section 3.2.5.) This field contains one Date.

Subject BASIC 07 007
16 8

This field contains whatever information the originator provided to summarize or indicate the nature of the message. This field contains one or more ASCII-Strings.

Text BASIC 04 004
16 8

This field contains the primary content of the message. Contents of this field are unrestricted.

To REQUIRED 05 005
16 8

This field identifies primary recipients for a message. This field contains one or more recipient identities.

Warning-Date OPTIONAL 24 044
16 8

This field is used either alone or in conjunction with an End-Date field. It contains one or more dates. These dates could be used by a message processing program as warnings of an impending end-date or other event. (See also Section 3.2.5.) This field contains one or more Dates.

APPENDIX B
DATA ELEMENTS -- IMPLEMENTORS' MASTER REFERENCE

The appendix defines all of the data elements in the message format specification, for reference use by implementors. It contains no new information but rather consolidates the syntactic information from Section 4.3.

Each data element description has the following form.

Data Element Name (Compliance) (Category) identifier octet 16 identifier octet 8

Constructive class (primitive or constructor)

Description of the syntax of the data element.

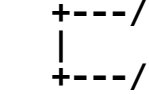
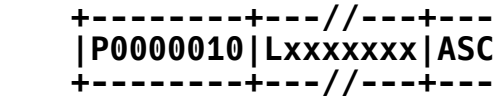


Diagram representing data element

ASCII-String (BASIC) 02 16 002 8

primitive

This data element contains a series of ASCII characters, each character right-justified in one octet. For seven-bit ASCII characters, the most significant bit of each octet must be 0.

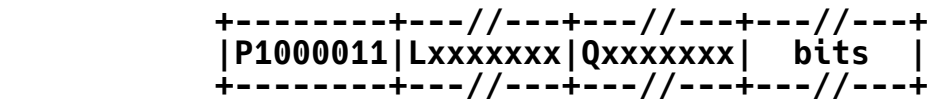


Bit-String (OPTIONAL) 43 103
16 8

primitive

This data element contains a series of bits. It uses the Qualifier data element component to record the number of bits of padding (as an eight bit unsigned integer) needed to fill the final octet of the Data Element Contents to an even octet boundary. These padding bits have no meaning and occur in the low order bits of the final octet. The valid values for the Qualifier component are 0 through 7. The number of bits in the Data Element Contents is calculated from the following formula.

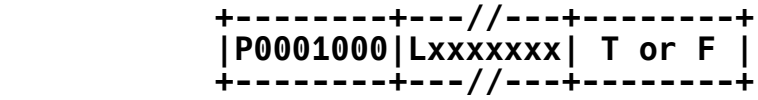
8 * number of octets in the Data Element Contents - value of Qualifier component



Boolean (OPTIONAL) 08 010
16 8

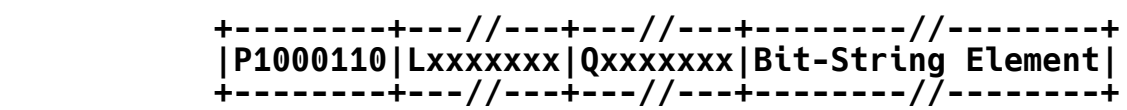
primitive

This data element contains one octet whose value is either true or false. False is represented by all bits being 0; true is represented by all bits being 1 (although any non-zero value should be interpreted as true).



Compressed (OPTIONAL) 46 106
16 8
constructor

This data element must contain a Bit-String data element. It is used to represent any data that has been compressed; it may be used wherever its uncompressed contents may appear. A Qualifier data component appears in each Compressed data element; it contains a compression identifier (CID) to identify the compression algorithm used. (See Section 4.3.5.) The Data Element Contents contains the product of the compression process.

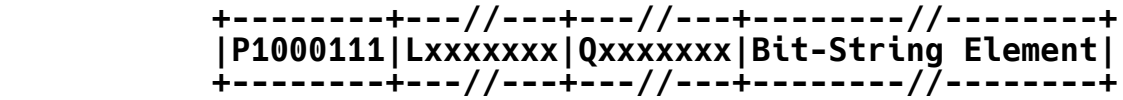


Date (BASIC) 28 050
16 8
constructor

This data element contains an ASCII-String data element, which is a representation of a date and time formatted in accordance with FIPS Publications 4 [NatB-68], 59 [NatB-79b], and 58 [NatB-79a].

Encrypted (OPTIONAL) 47 107
16 8
constructor

This data element must contain a Bit-String. It is used to represent any data that has been encrypted; it may be used wherever its unencrypted contents may appear. A Qualifier data component appears in each Encrypted data element; it contains an encryption identifier (EID) identifying the encryption algorithm used. (See Section 4.3.4.) The Data Element Contents is the product of the encryption process.

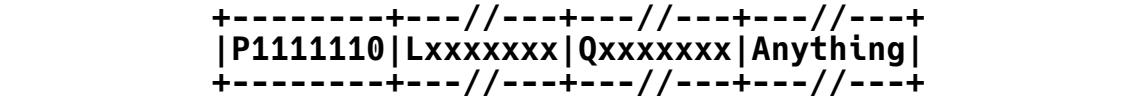


End-of-Constructor (BASIC) 01 001
16 8
primitive

This data element terminates the Data Element Contents in a constructor data element that has indefinite length. This data element has no Contents component. (Use of this element is described in Section 4.2.2.1.)

Extension (OPTIONAL) 7E 176
16 8
constructor

This data element is used to extend the number of available data elements beyond the 128 that are possible using a 7-bit identifier. A Qualifier component extends the encoding space for identifiers. (Extension and Vendor-Defined have the same syntax.)



Field (BASIC) 4C 114
16 8
constructor

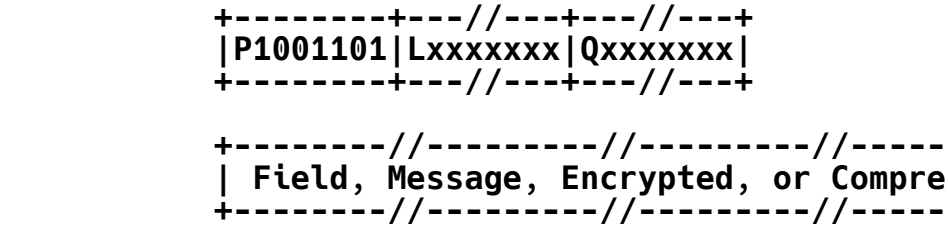
This data element uses a Qualifier data element component. The Qualifier component contains a Field Identifier (FID) indicating which specific field is being represented. (See Section 4.3.2.)

Integer (OPTIONAL) 20 040
16 8
primitive

This data element contains a 2's complement integer of variable length, high order octet first. It is recommended that the data element contents be either 2 or 4 octets long whenever possible.

Message (BASIC) 4D 115
16 8
constructor

This data element may contain Field or Message data elements. Its Qualifier component contains a Message type (MID) indicating the type of the message. (See Section 4.3.6.) (The MID is completely different from the message identifier in the Message-ID field and should not be confused with it.)

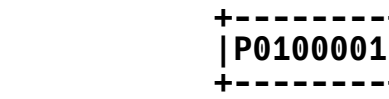


No-Op (OPTIONAL) 00 000
16 8
primitive

This data element does nothing. No-Op is used whenever it is necessary to include a data element that means "no operation". It is a short placeholder.

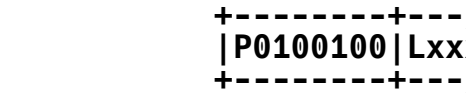
Padding (OPTIONAL) 21 041
16 8
primitive

This data element is used to fill any number of octets. The contents of a Padding element are undefined and convey no information.



Property-List (OPTIONAL) 24 044
16 8
constructor

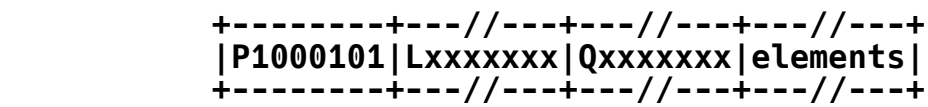
This data element contains a series of Property data elements to be associated with another data element.



Property (OPTIONAL) 45 (16) 105 (8)

constructor

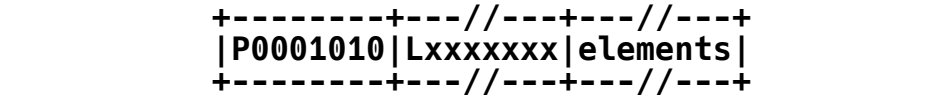
This data element uses a Qualifier data element component. The Qualifier component contains a Property-Identifier (PID) to indicate which specific property is being represented. (See Section 4.3.3.)



Sequence (OPTIONAL) 0A (16) 012 (8)

constructor

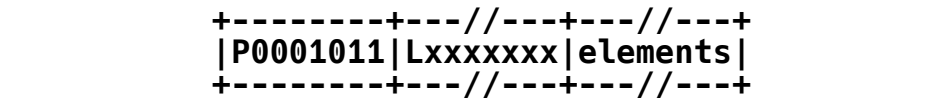
This data element contains any series of data elements. Sequence differs from Set in that the data elements making up the Data Element Contents must be considered as an ordered sequence (according to their order of appearance in the sequence.)



Set (OPTIONAL) 0B (16) 013 (8)

constructor

This data element contains any series of data elements with no ordering of the elements implied. (Sequence provides an ordered series.) Although the data elements contained in a Set must be stored sequentially, the order in which they are stored is not defined and not processed.



Unique-ID (OPTIONAL) 09 011
16 8
constructor

This data element is a unique identifier. It need not be human-readable. The Data Element Contents may be an ASCII-String, a Bit-String, or an Integer.

```
+--------+---//---+---//---+
|P0001001|Lxxxxxxx| element|
+--------+---//---+---//---+
```

Vendor-Defined (OPTIONAL) 7F 177
16 8
constructor

This data element is used to represent vendor-defined data elements. A Qualifier component extends the encoding space for identifiers. The Qualifier component is not guaranteed to be unique among all interconnected ems. This data element is interpreted according to prior agreement between systems. (Extension and Vendor-Defined data elements have the same syntax.)

```
+--------+---//---+---//---+---//---+
|P1111111|Lxxxxxxx|Qxxxxxxx|Anything|
+--------+---//---+---+---//---+
```

APPENDIX C
DATA ELEMENT IDENTIFIER OCTETS

Identifier	Identifier	Data Element Name
00	000	No-Op
01	001	End-of-Constructor
02	002	ASCII-String
08	010	Boolean
09	011	Unique-ID
0A	012	Sequence
0B	013	Set
20	040	Integer
21	041	Padding
24	044	Property-List
28	050	Date
43	103	Bit-String
45	105	Property
46	106	Compressed
47	107	Encrypted
4C	114	Field
4D	115	Message
7E	176	Extension
7F	177	Vendor-Defined

APPENDIX D
SUMMARY OF MESSAGE FIELDS BY COMPLIANCE CATEGORY

This appendix is for reference use. It contains no new information, but rather abstracts from that presented in Section 3.1.

This appendix contains the message field names arranged alphabetically within compliance category. (Appendix E orders the field names within functional category.) Complete field definitions appear in Appendix A.

Required fields must appear in a message. Basic fields must be recognized and processed by all CBM systems. Optional fields need not be supported by a CBMS but, if supported, must be processed according to the meanings defined by the message format specification.

D.1 REQUIRED Fields

From
Posted-Date
To

D.2 BASIC Fields

Cc
Reply-To
Subject
Text

D.3 OPTIONAL Fields

Attachments
Author
Bcc
Circulate-Next
Circulate-To
Comments

Date
End-Date
In-Reply-To
Keywords
Message-Class
Message-ID
Obsoletes
Originator-Serial-Number
Precedence
Received-Date
Received-From
References
Reissue-Type
Sender
Start-Date
Warning-Date

APPENDIX E
SUMMARY OF MESSAGE SEMANTICS BY FUNCTION

This appendix is for reference use. It contains no new information, but rather abstracts from that presented in Section 3.1.

This appendix contains the message field names arranged alphabetically within functional class. (Appen orders the field names within compliance class.) Complete field definitions appear in Appendix A.

E.1 Circulation

Circulate-Next
Circulate-To

E.2 Cross Referencing

In-Reply-To
Message-ID
Obsoletes
Originator-Serial-Number
References

E.3 Life spans

End-Date
Start-Date
Warning-Date

E.4 Delivery System

Received-Date
Received-From

E.5 Miscellaneous Fields Used Generally

Attachments
Comments
Keywords
Message-Class
Precedence
Subject
Text

E.6 Reply Generation

Reply-To

E.7 Reissuing

Reissue-Type

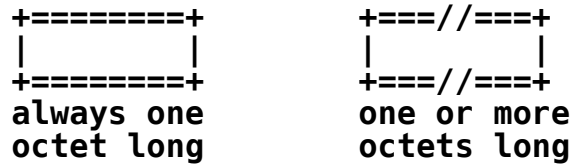
E.8 Sending (Normal Transmission)

Author
Bcc
Cc
Date
From
Posted-Date
Sender
To

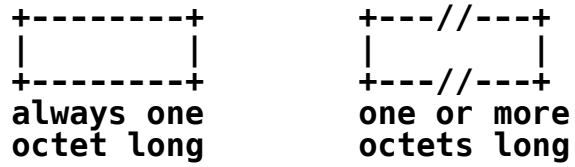
APPENDIX F
SUMMARY OF DATA ELEMENT SYNTAX

This appendix summarizes data element syntax by diagramming the components of data elements. Detailed presentation of data element syntax appears in Section 4.3.1.

In these diagrams, required components of a data element appear as follows. (The double border signifies "required".)



Optional components of data elements are represented as follows. (The single border signifies "not required".)



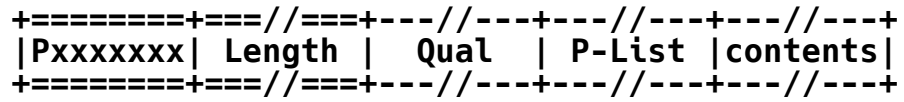
The first octet in a data element is the identifier octet. In diagrams of data elements, all eight bits of the identifier octet are always shown. Bits with fixed values show the fixed values as 1s and 0s. Bits with variable values are shown as x's and y's.

The first bit in an identifier octet is the P-bit. Its value indicates whether a data element contains a property list. (A P-bit value of 1 indicates the presence of a property list.) The remaining seven bits contain the rest of the identifier.

Other octets in a data element belong to one of four classes, Length Code, Qualifier, Property-List, and Contents. In diagrams of syntax the data element components are labeled according to their class.

Component Class	Label
Length code	Length
Qualifier	Qual
Property-List	P-List
Contents	Contents

Data elements must follow this form.



The value of the Length component is the total number of octets following the length code octet in the data element.

APPENDIX G
SUMMARY OF DATA ELEMENTS BY COMPLIANCE CATEGORY

Compliance categories for syntactic elements are basic and optional. Every CBMS is required to recognize and process basic elements. A CBMS is not required to process optional elements although many are strongly recommended by the semantics.

This appendix summarizes data elements by listing them according to their compliance category.

G.1 BASIC Data Elements

ASCII-String	(primitive)	02_{16}	002_{8}
Date	(constructor)	28_{16}	050_{8}
End-Of-Constructor	(primitive)	01_{16}	001_{8}
Field	(constructor)	$4C_{16}$	114_{8}
Message	(constructor)	$4D_{16}$	115_{8}

G.2 OPTIONAL Data Elements

Bit-String	(primitive)	43_{16}	103_{8}
Boolean	(primitive)	08_{16}	010_{8}
Compressed	(constructor)	46_{16}	106_{8}
Encrypted	(constructor)	47_{16}	107_{8}
Extension	(constructor)	$7E_{16}$	176_{8}
Integer	(primitive)	20_{16}	040_{8}
No-Op	(primitive)	00_{16}	000_{8}
Padding	(primitive)	21_{16}	041_{8}

Property	(constructor)	45 (16)	105 (8)
Property-List	(constructor)	24 (16)	044 (8)
Sequence	(constructor)	0A (16)	012 (8)
Set	(constructor)	0B (16)	013 (8)
Unique-ID	(constructor)	09 (16)	011 (8)
Vendor-Defined	(constructor)	7F (16)	377 (8)

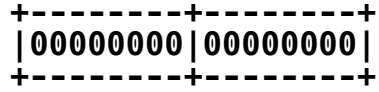
APPENDIX H
EXAMPLES

This appendix presents at least one example for each of the data elements defined in this message format specification. In these examples, identifier octets are represented in binary form. All other numbers are presented in hexadecimal. ASCII strings are shown as characters rather than their numerical representation. Although this message format specification does not define the syntax of names and addresses, message originators and recipients are identified by their names. This does not imply anything about how naming and addressing can or should be done; it is simply a convenient way to identify message originators and recipients in these examples.

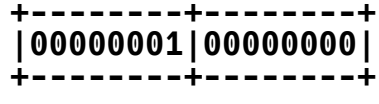
H.1 Primitive Data Elements

This section contains an example of each of the primitive data elements. Each example contains a short explanation and a series of octets.

No-Op data element:

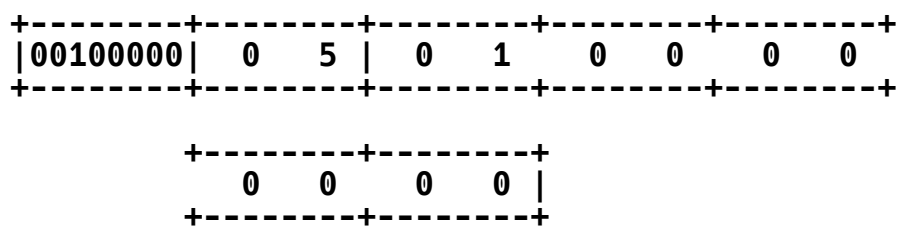


End-of-Constructor data element:



Boolean data element whose value is true:

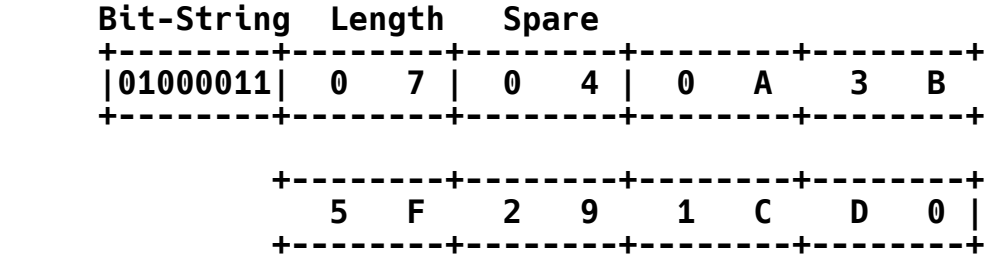
Integer data element containing five octets of data. Its value is 4,294,967,296 (decimal):



Padding data element containing three octets of padding. The values of those three octets are meaningless:

ASCII-String data element containing nine characters. Its value is "Hi There.":

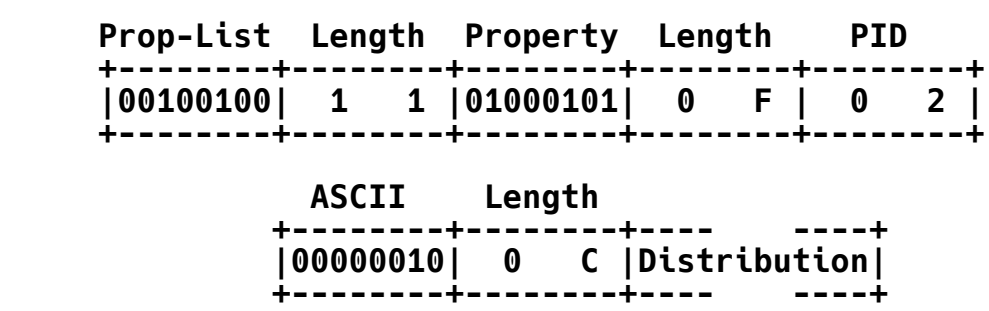
Bit-String data element containing 44 bits of data (((7-1) x 8) - 4). Six octets are used to hold those 44 bits. The last 4 bits in the final octet are padding and are therefore ignored.



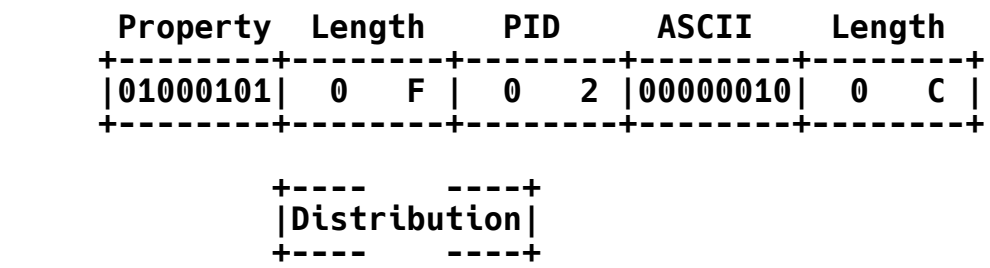
H.2 Constructor Data Elements

This section contains an example of each of the constructor data elements. Each example contains a short explanation and then an annotated series of the data elements making up the constructor.

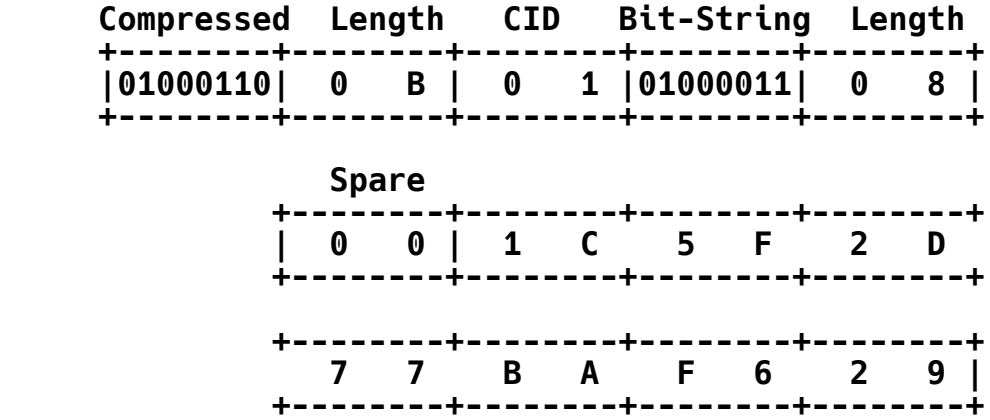
Property-List data element containing one Property data element. The property is Printing-Name and its value is "Distribution":



Printing-Name Property. The value of the Printing-Name is "Distribution":



Compressed data element. Its contents were compressed using an as-yet-undefined NBS standard data compression algorithm. The compressed data is in a bit-string that is 56 bits long, fully filling 7 octets:



Encrypted data element. The encryption method used to encrypt its contents has been intentionally not specified. This element contains a Bit-String which contains 22 bits (((4-1) x 8) - 2) of data. These 22 bits are represented in octets; the final 2 bits in the final octet are padding and are therefore ignored:

```
Encrypted   Length   EID   Bit-String  Length
+--------+--------+--------+--------+--------+
|01000111|  0   7 |  0   0 |01000011|  0   4 |
+--------+--------+--------+--------+--------+

           Spare
         +--------+--------+--------+--------+
         |  0   2 |  A   3    7   8    1   C |
         +--------+--------+--------+--------+
```

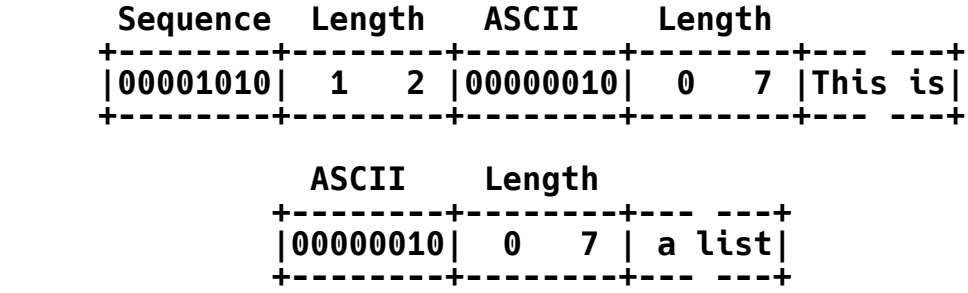
Date data element. This example includes a date but no time. The date shown in this example is August 15, 1980:

```
  Date     Length   ASCII    Length
+--------+--------+--------+--------+---  ---+
|00101000|  0   A |00000010|  0   8 |19800815|
+--------+--------+--------+--------+---  ---+
```

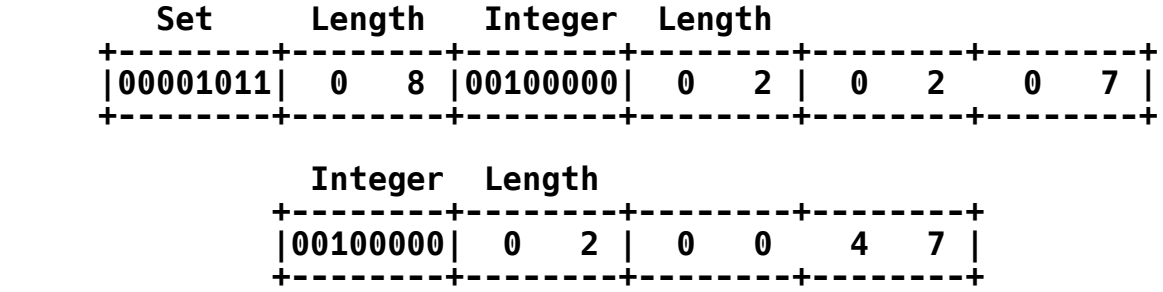
Unique-ID data element, which is represented as an Integer data element whose value is 129 (decimal).

```
Unique-ID  Length   Integer  Length
+--------+--------+--------+--------+--------+--------+
|00001001|  0   4 |00100000|  0   2 |  0   0    8   1 |
+--------+--------+--------+--------+--------+--------+
```

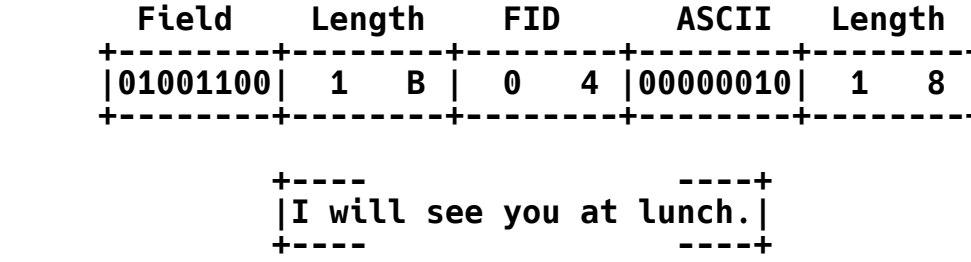
Sequence data element containing two ASCII-String data elements. The first ASCII-String is "This is" while the second string is " a list":



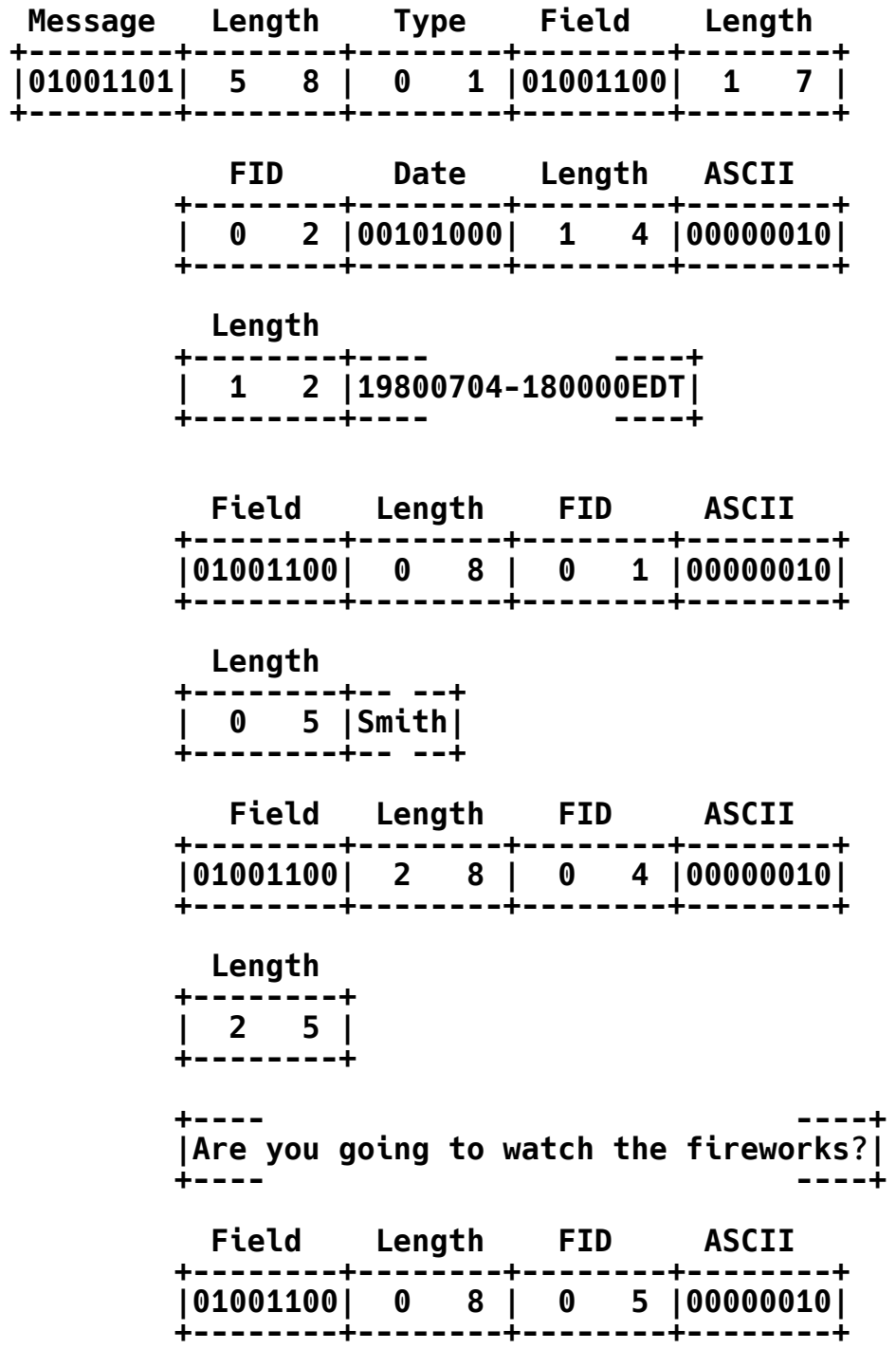
Set data element containing two Integer data elements. The first integer has a value of 519 (decimal) while the value of the second is 71 (decimal). (These two value have no ordering because they belong to a set.)

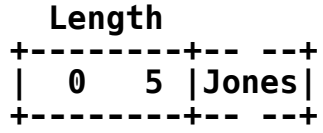


Field data element. The specific field shown is the Text field with the contents "I will see you at lunch.":

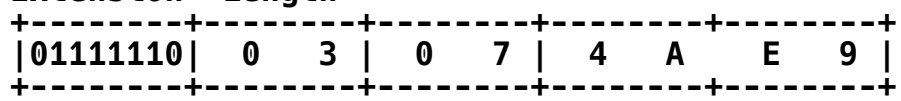


Message containing four fields, Posted-Date, From, Text, and To. It was sent on July 4, 1980 at 6 p.m. eastern daylight time. It is from a person named Smith. The text of the message is a question asking the recipient "Are you going to watch the fireworks?". The message is sent to Jones:

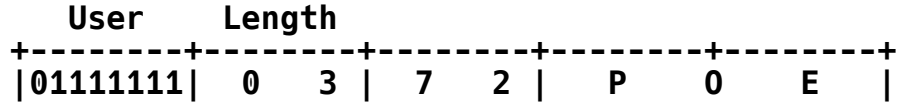




Extension data element containing a length code and 3 octets. The octet immediately following the length code identifies it as Extension Data Element 7. The Data Element Contents is the final two octets. The interpretation of the Data Element Contents would be defined in an extension or successor to this message format specification. [Note: this is an example. Any actual extension data element 7 (if it were ever used) would be completely different from anything done here.]:



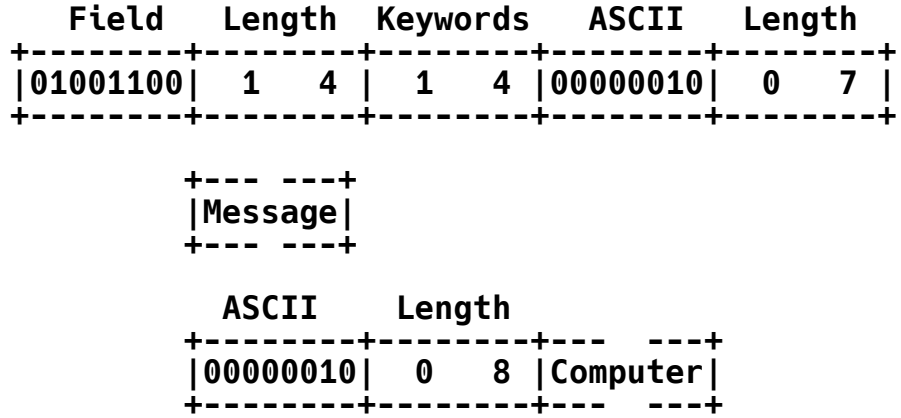
Vendor-Defined data element containing a length code and 3 octets. The first octet identifies this as vendor-defined data element number 114 (decimal), which this particular vendor has defined to contain three printable ASCII characters in two octets. (Data element 114 (decimal) for another user would be completely different. For example, it might contain a floating point number.):



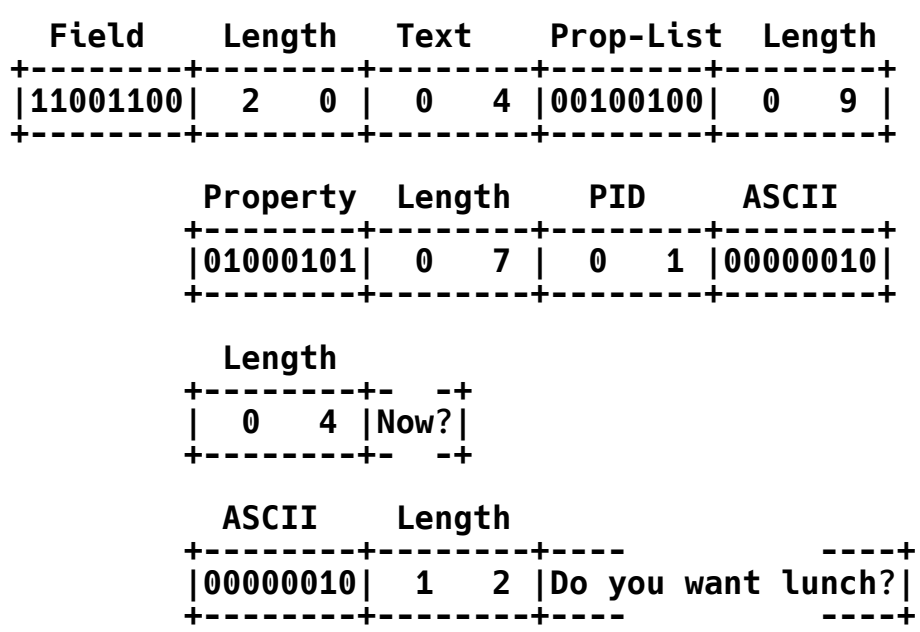
H.3 Fields

This section contains examples of Field data element constructors for each several different fields (Keywords, Text, Subject, Vendor-Defined).

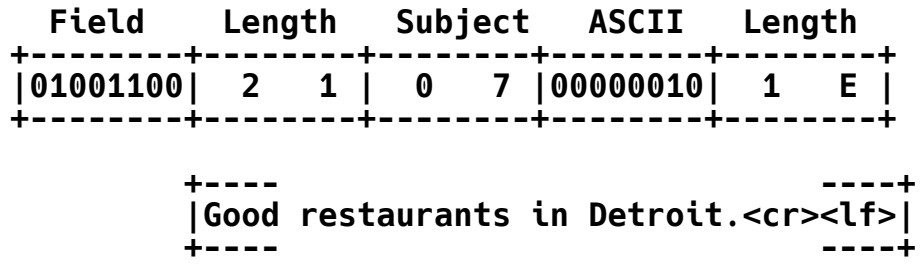
Field data element for keywords . The field contains two keywords, Message and Computer, each represented in a separate ASCII-string data element.



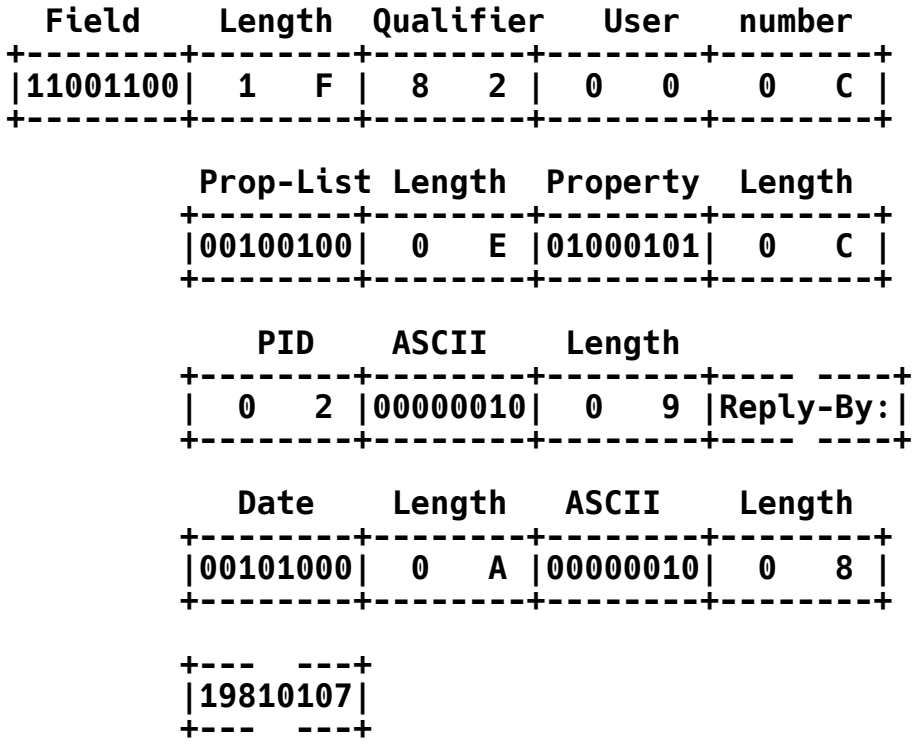
Field data element for Text with a Property-List data element containing a comment attached. The text field contains the ASCII-String data element "Do you want lunch?"; the Property-List data element contains a comment property, which consists of an ASCII-string data element containing "Now?":



Field data element for Subject containing an ASCII-String data element ("Good restaurants in Detroit" followed by a carriage return and a line feed). (A recipient would expect the message to contain some information about restaurants in the Detroit area.):



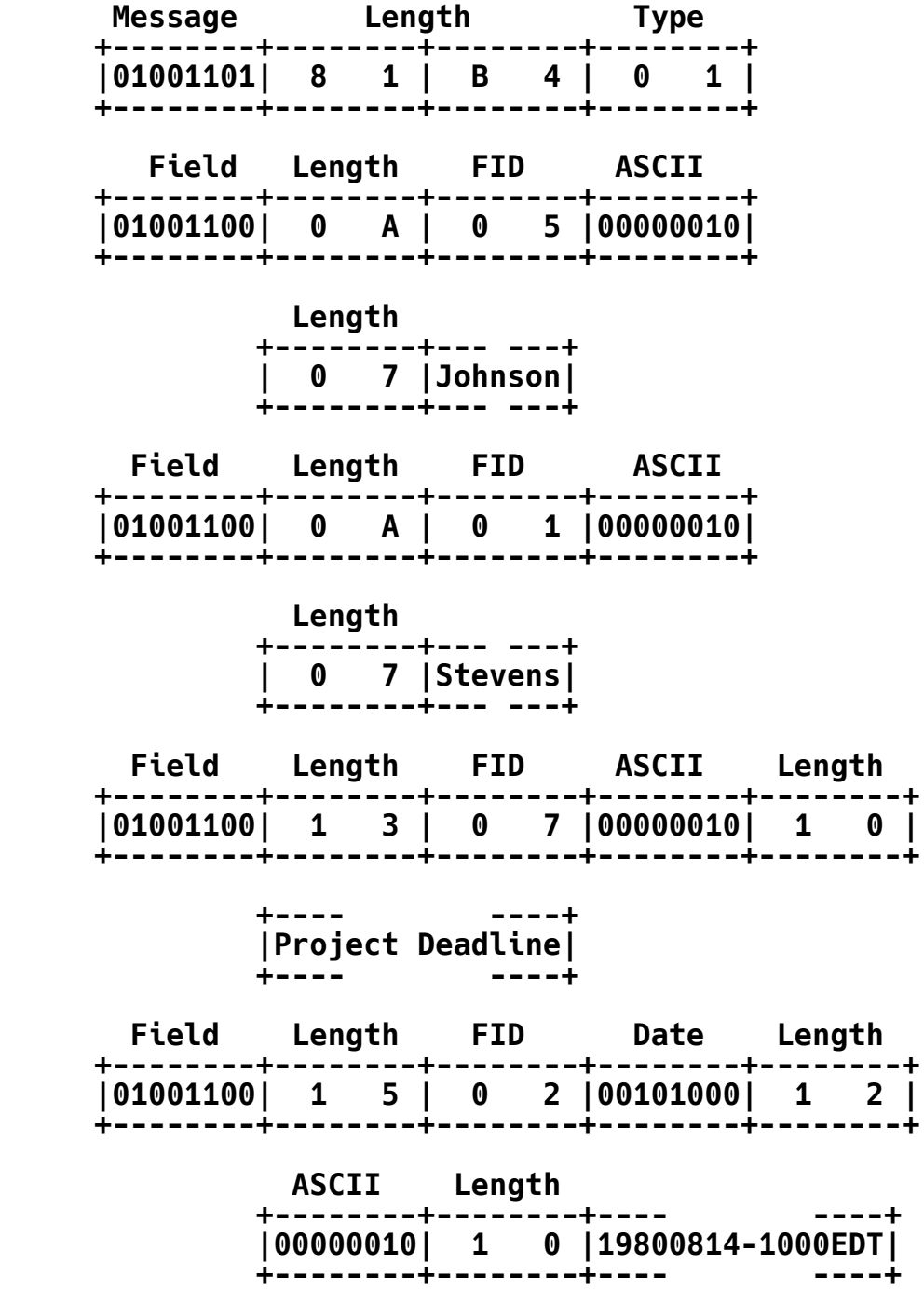
Field data element whose form and meaning was defined by a vendor. This vendor has defined vendor-defined field 12 (decimal) to be a field with a printing name of "Reply-by" and contents consisting of a date; January 7, 1981 in this case. (The meaning of vendor-defined field 12 is unique to the vendor; the same field number would have different meaning for other vendors.):

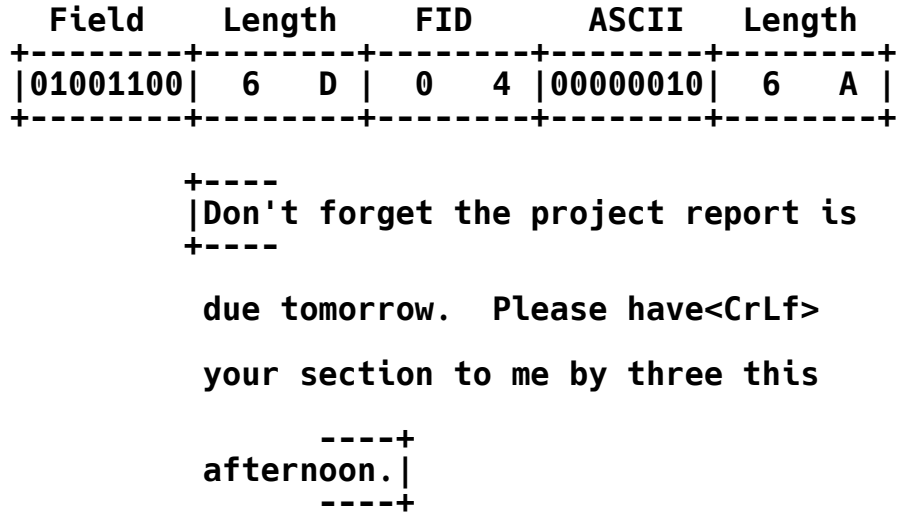


H.4 Messages

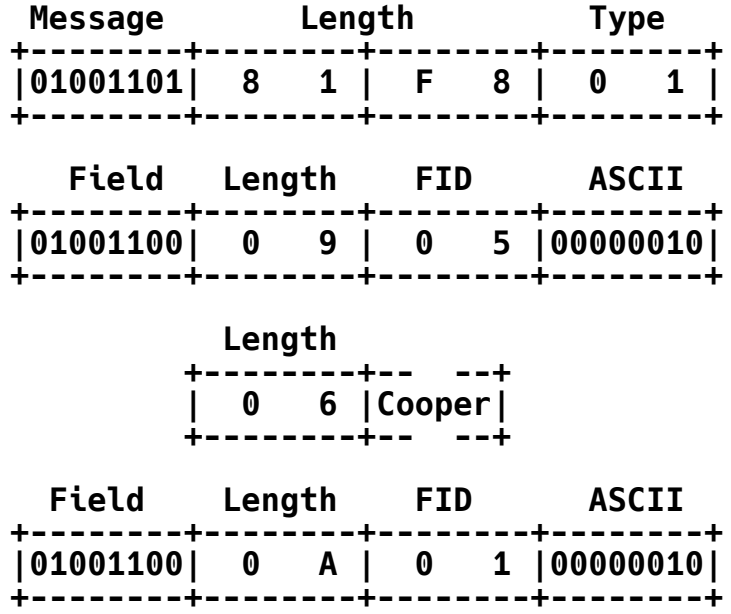
This section contains several examples of complete messages and shows the results of reissuing a message. (See Section 3.2.2.)

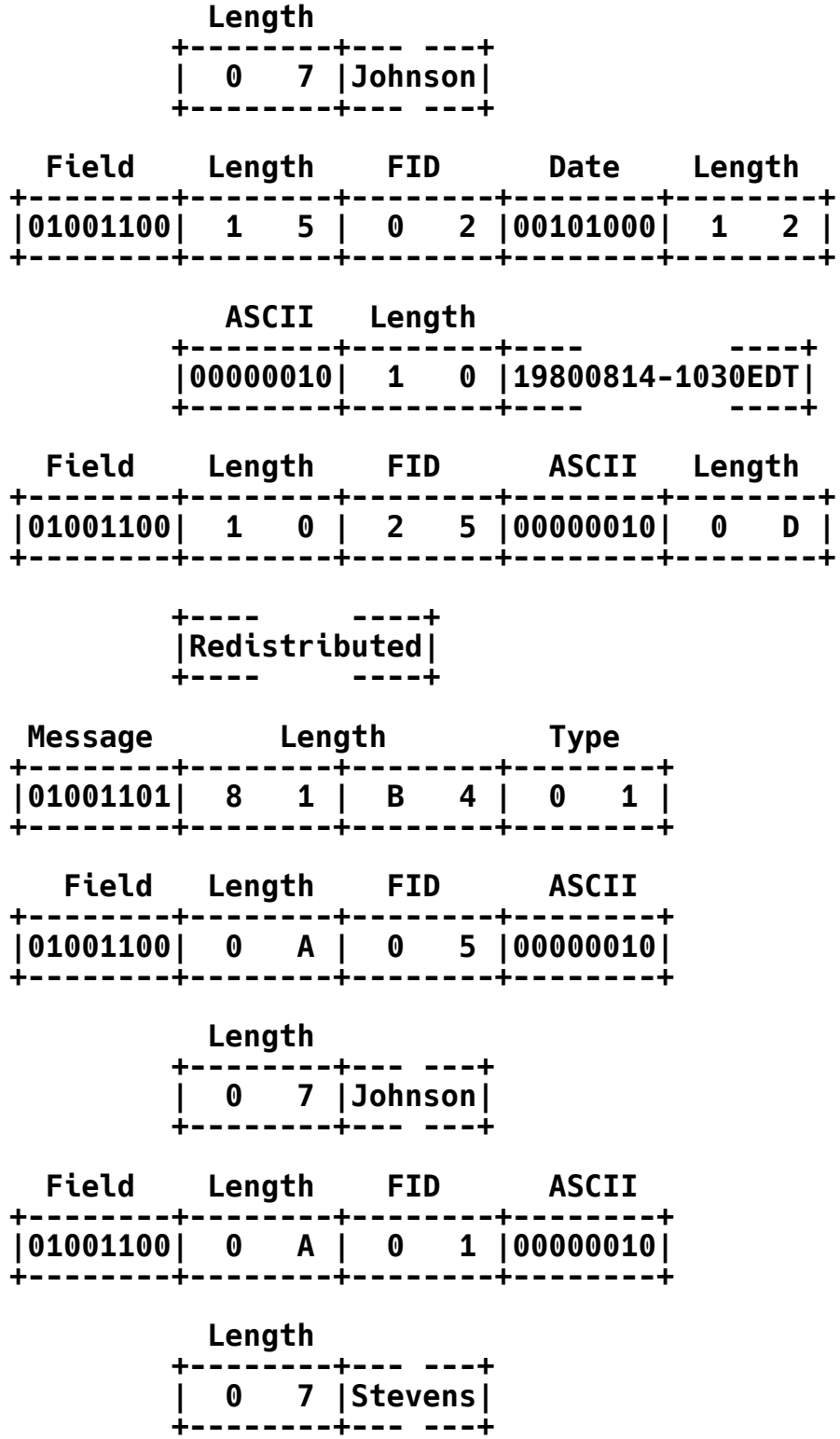
The following sample message had Stevens as its originator and Johnson as its recipient. The message was sent on August 14, 1980 at 10 am EDT. The subject of the message is "Project Deadline" and the message is a reminder that the deadline is the next day and that the section of the report for the project being done by Johnson should be turned in to Stevens by 3 pm that day.

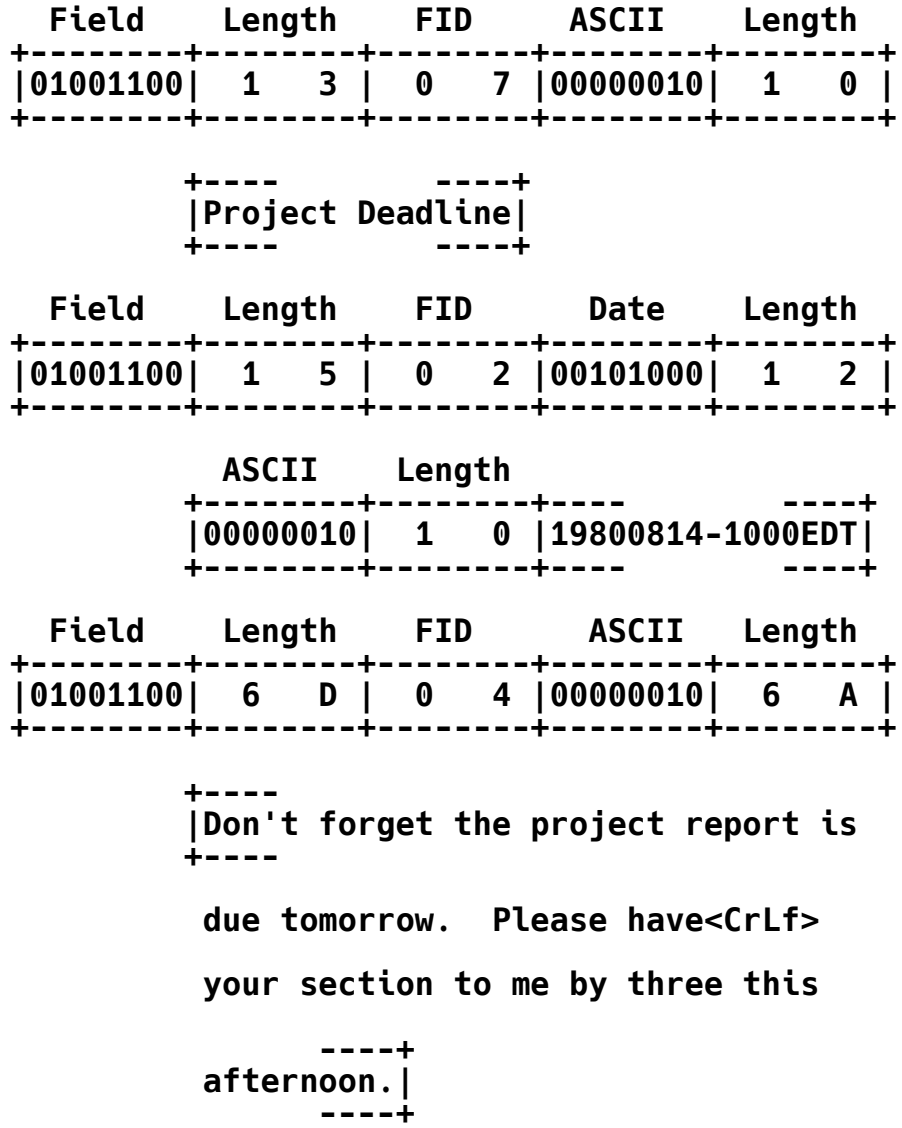




The following example illustrates the results of reissuing the first message in this section. This message contains the original message (as a Message data element), To, From, and Posted-Date fields, and a Reissue-Type field with Redistributed as its value:



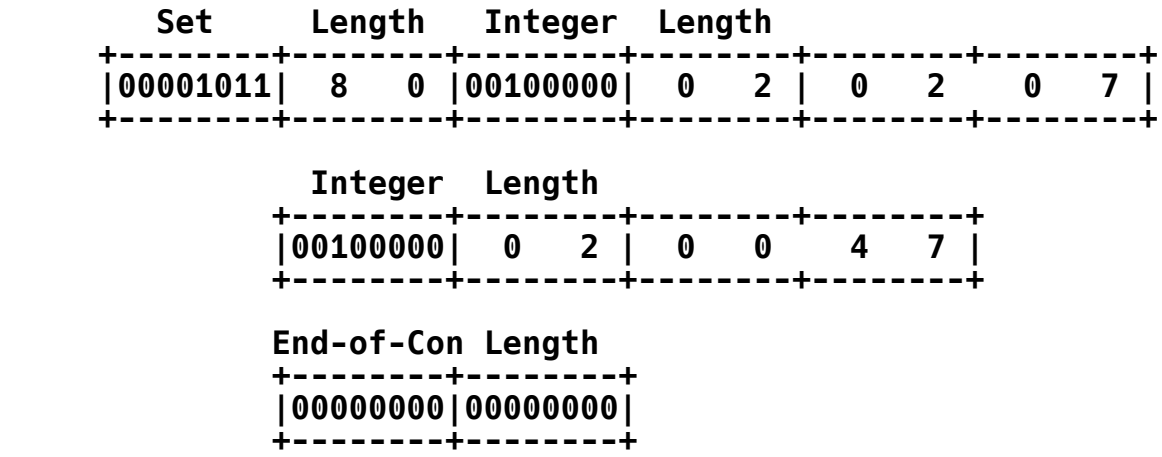

Length
0 7 Johnson
Field Length FID Date Length
01001100 1 5 0 2 00101000 1 2
ASCII Length
00000010 1 0 19800814-1030EDT
Field Length FID ASCII Length
01001100 1 0 2 5 00000010 0 D
Redistributed
Message Length Type
01001101 8 1 B 4 0 1
Field Length FID ASCII
01001100 0 A 0 5 00000010
Length
0 7 Johnson
Field Length FID ASCII
01001100 0 A 0 1 00000010
Length
0 7 Stevens



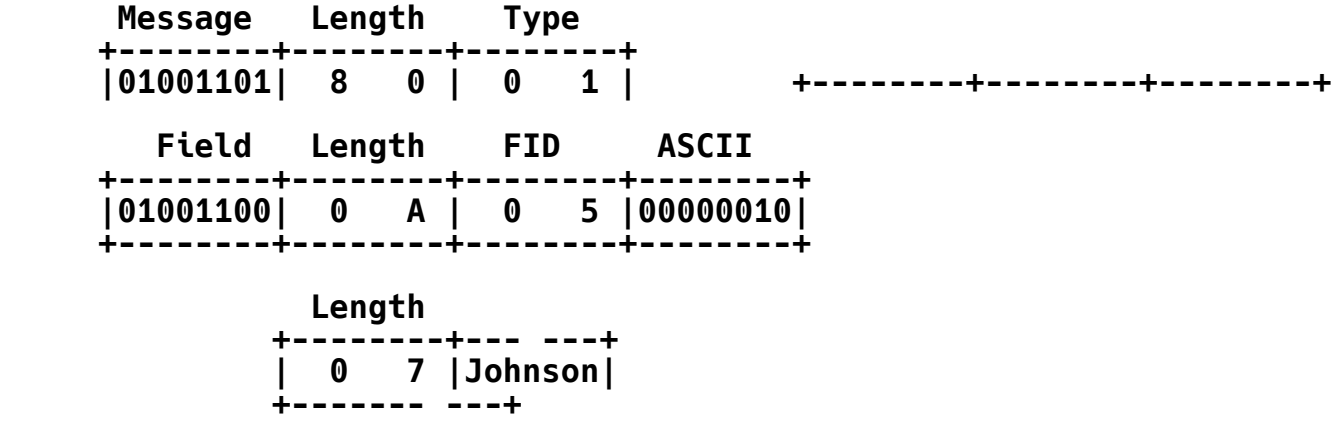
H.5 Unknown Lengths

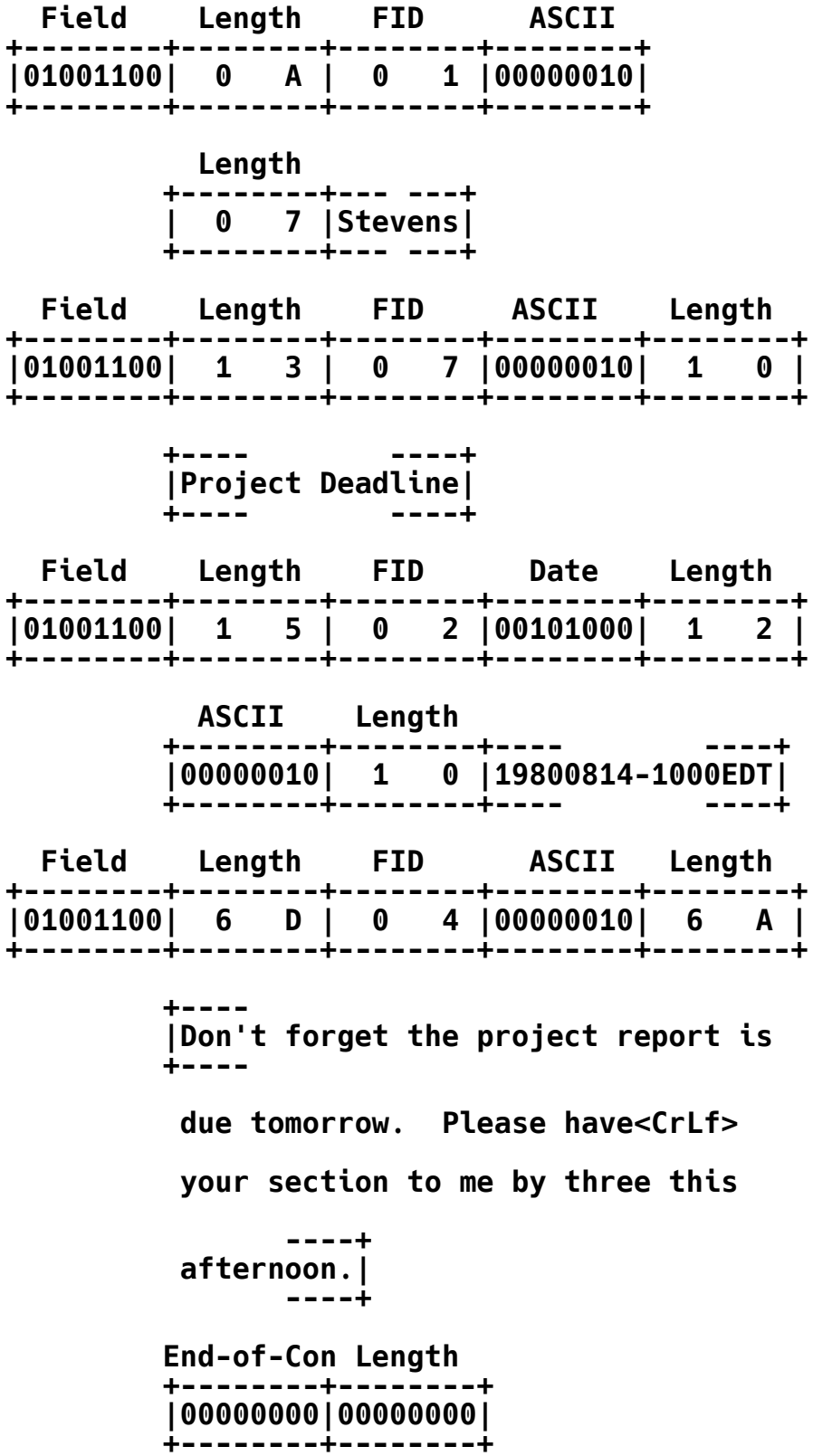
This section contains two examples of data elements with an unknown length. The two examples have been presented in sections H.2 and H.4, but with a known rather than an unknown length.

Set data element with an unknown length containing two Integer data elements. The first integer has a value of 519 (decimal) while the value of the second is 71 (decimal). (These two value have no ordering because they belong to a set.)



The following sample message with an unknown length had Stevens as its originator and Johnson as its recipient. The message was sent on August 14, 1980 at 10 am EDT. The subject of the message is "Project Deadline" and the message is a reminder that the deadline is the next day and that the section of the report for the project being done by Johnson should be turned in to Stevens by 3 pm that day.




Field Length FID ASCII
01001100 0 A 0 1 00000010
Length
0 7 Stevens
Field Length FID ASCII Length
01001100 1 3 0 7 00000010 1 0
Project Deadline
Field Length FID Date Length
01001100 1 5 0 2 00101000 1 2
ASCII Length
00000010 1 0 19800814-1000EDT
Field Length FID ASCII Length
01001100 6 D 0 4 00000010 6 A
Don't forget the project report is
due tomorrow. Please have<CrLf>
your section to me by three this
afternoon.
End-of-Con Length
00000000 00000000

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INDEX

ASCII-String 29, 30, 42, 45, 47, 49, 53, 54, 55, 57, 59, 63
Assignment 17, 22, 55
Attachments 17, 52
Audit trail 20
Author 14, 52

BASIC 13
BASIC Data Elements
  ASCII-String 42, 57
  Date 45, 59
  End-of-Constructor 43, 60
  Field 46, 60
  Message 46, 61
BASIC fields
  Cc 14
  Reply-To 14
  Subject 17
  Text 17
BASIC syntactic elements 29
Bcc 14, 19, 20, 52
Bit numbering in octets 32
Bit-String 30, 37, 42, 44, 45, 47, 57, 58, 59, 63
Boolean 30, 43, 58

Cc 14, 19, 52
Chains of correspondence 24
Circulate-Next 15, 26, 53
Circulate-To 15, 26, 53
Circulation 26
Comment 30, 31, 38, 49
Comments 18, 53
Compliance requirements 34
Compressed 31, 37, 44, 49, 58
Compression identifier 44, 58
Compression Identifiers
  NBS-Standard 49
  Unspecified 49
Constructor data element 29, 30
Contents 32, 70
Cross Referencing 24

Data Element Contents 37, 38, 39, 81, 36, 39, 47, 63, 36, 38, 39, 41, 42, 47, 57, 63, 81
Data Elements

ASCII-String (BASIC) 42, 57
Bit-String (OPTIONAL) 42, 57
Boolean (OPTIONAL) 43, 58
Compressed (OPTIONAL) 44, 58
Date (BASIC) 45, 59
Encrypted (OPTIONAL) 45, 59
End-of-Constructor (BASIC) 43, 60
Extension (OPTIONAL) 45, 60
Field (BASIC) 46, 60
Integer (OPTIONAL) 43, 61
Message (BASIC) 46, 61
No-Op (OPTIONAL) 44, 61
Padding (OPTIONAL) 44, 62
Property (OPTIONAL) 47, 62
Property-List (OPTIONAL) 46, 62
Sequence (OPTIONAL) 47, 63
Set (OPTIONAL) 47, 63
Unique-ID (OPTIONAL) 47, 63
Vendor-Defined (OPTIONAL) 48, 64
Date 15, 45, 53, 54, 55, 56, 59
Dating 25
Delivery 9, 15, 54
Delivery Protocol 9
Delivery Slot 9

Encapsulating 22
Encrypted 31, 37, 45, 49, 59
Encryption identifier 45, 59
Encryption Identifiers
NBS-Standard 49
Unspecified 49
End-Date 15, 25, 53, 56
End-Of-Constructor 30, 36, 39, 43, 60
Extension 41, 45, 60

Field 10, 26, 29, 30, 31, 37, 46, 60, 61, 66
Field Identifier 46, 60
Field label presentation 29
Fields
Attachments (OPTIONAL) 52, 17
Author (OPTIONAL) 52, 14
Bcc (OPTIONAL) 52, 14
Cc (BASIC) 52, 14
Circulate-Next (OPTIONAL) 53, 15
Circulate-To (OPTIONAL) 53, 15
Comments (OPTIONAL) 53, 18
Date (OPTIONAL) 53, 15
End-Date (OPTIONAL) 53, 15
From (REQUIRED) 53, 14
In-Reply-To (OPTIONAL) 53, 16
Keywords (OPTIONAL) 53, 18

Message-Class (OPTIONAL) 54, 17
Message-ID (OPTIONAL) 54, 16
Obsoletes (OPTIONAL) 54, 16
Originator-Serial-Number (OPTIONAL) 54, 16
Posted-Date (REQUIRED) 54, 15
Precedence (OPTIONAL) 54, 16
Received-Date (OPTIONAL) 54, 15
Received-From (OPTIONAL) 55, 17
References (OPTIONAL) 55, 16
Reissue-Type (OPTIONAL) 55, 17
Reply-To (BASIC) 55, 14
Sender (OPTIONAL) 55, 14
Start-Date (OPTIONAL) 55, 15
Subject (BASIC) 55, 17
Text (BASIC) 56, 17
To (REQUIRED) 56, 14
Warning-Date (OPTIONAL) 56, 15
From 12, 14, 23, 52, 53, 55

Globally unique identifiers 24

Identifier octet 33, 35, 32, 33, 36, 39, 40, 70
Identifiers
globally unique 24
In-Reply-To 16, 24, 53
Indefinite length code 35
Integer 30, 43, 47, 61, 63

Keywords 18, 53, 81

Length Code 34, 36, 32, 33, 34, 35, 36, 37, 39, 40, 70, 71, 81
Long length code 35

Message Transfer System 8, 9, 17, 54
Message 10, 12, 29, 30, 31, 37, 46, 61
Message content 9
Message envelope 9
Message stores 25
Message Transfer System 9, 17, 20, 55, 8, 9, 10, 12, 15, 16, 20, 54, 55
Message Types
NBS-Standard 50
Message-Class 17, 54
Message-ID 16, 24, 26, 53, 54, 55

NBS-Standard 49, 50
No-Op 44, 61
Numbering bits in octets 32

Obsoletes 16, 24, 54

Octets
   bit numbering in   32
OPTIONAL   13
OPTIONAL Data Elements
   Bit-String   42, 57
   Boolean   43, 58
   Compressed   44, 58
   Encrypted   45, 59
   Extension   45, 60
   Integer   43, 61
   No-Op   44, 61
   Padding   44, 62
   Property   47, 62
   Property-List   46, 62
   Sequence   47, 63
   Set   47, 63
   Unique-ID   47, 63
   Vendor-Defined   48, 64
OPTIONAL fields
   Attachments   17
   Author   14
   Bcc   14
   Circulate-Next   15
   Circulate-To   15
   Comments   18
   Date   15
   End-Date   15
   In-Reply-To   16
   Keywords   18
   Message-Class   17
   Message-ID   16
   Obsoletes   16
   Originator-Serial-Number   16
   Precedence   16
   Received-Date   15
   Received-From   17
   References   16
   Reissue-Type   17
   Sender   14
   Start-Date   15
   Warning-Date   15
OPTIONAL syntactic elements   29
Originator   11, 13, 15, 25, 52, 53, 55
Originator-Serial-Number   16, 25, 54

Padding   44, 62
Person   13
Posted-Date   12, 15, 26, 53, 54
Posting   9
Posting Protocol   9
Posting Slot   9

Precedence 16, 54
Precedence categories 17
Precedence scheme 54
Presentation
   field label 29
Primitive data element 30, 29, 30
Printing-Name 30, 38, 49, 76
Process 13
Properties
   Comment 49
   Printing-Name 49
Property 32, 37, 46, 47, 62
Property-Identifier 47, 62
Property-List 30, 32, 33, 38, 39, 40, 46, 62, 70

Qualifier 32, 33, 34, 36, 37, 39, 40, 42, 44, 45, 46,
      47, 48, 57, 58, 59, 60, 62, 64, 70
Qualifiers 37

Received-Date 15, 54
Received-From 17, 55
Recipient 11, 14, 17, 52, 53, 55, 56
Redistribution 17, 22, 55
References 16, 24, 55
Reissue-Type 17, 55
Reply 13, 23
Reply-to 14, 23, 53, 55
REQUIRED 13
REQUIRED fields
   From 14
   Posted-Date 15
   To 14
Requirements
   compliance 34
Role 13

Sender 14, 26, 55
Sequence 29, 30, 47, 63
Sequences 30
Serial Numbers 16, 24, 54
Set 30, 47, 63
Short length code 35
Slot 9
Start-Date 15, 25, 55
Subject 17, 55
Syntactic reissuing 22

Text 17, 26, 56
To 12, 14, 19, 26, 30, 56

Unique identifiers 24

Unique-ID 47, 53, 54, 55, 63
Unspecified 49
User Agent 8, 9, 20
User interface 29

Vendor-Defined 41, 48, 64

Warning-Date 15, 25, 56