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МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ

Information processing systems — Open Systems Interconnection — File Transfer, Access and Management —

Part 4 : File Protocol Specification

Systèmes de traitement de l'information — Interconnexion de systèmes ouverts — Gestion, accès et transfert de fichier —

Partie 4 : Spécification du protocole de transfert de fichier

Reference number
ISO 8571-4 : 1988 (E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8571-4 was prepared by Technical Committee ISO/TC 97, *Information processing systems.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

ISO 8571 consists of the following parts, under the general title *Information processing systems — Open Systems Interconnection — File Transfer, Access and Management*

- *Part 1 : General introduction*
- *Part 2 : Virtual Filestore Definition*
- *Part 3 : File Service Definition*
- *Part 4 : File Protocol Specification*

Annexes A and B form an integral part of this International Standard. Annex C is for information only.

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0 Introduction

ISO 8571 is one of a set of International Standards produced to facilitate the interconnection of computer systems. Its relation to other International Standards in the set is defined by the Reference Model for Open Systems Interconnection (ISO 7498). The Reference Model subdivides the area of standardization for interconnection into a series of layers of specification, each of manageable size.

The aim of Open Systems Interconnection is to allow, with a minimum of technical agreement outside the interconnection standards, the interconnection of computer systems:

a) from different manufacturers,

b) under different managements,

c) of different levels of complexity,

d) of different ages.

ISO 8571 defines a file service and specifies a file protocol available within the application layer of the Reference Model. The service defined is of the category Application Service Element (ASE). It is concerned with identifiable bodies of information which can be treated as files, and may be stored within open systems or passed between application processes.

ISO 8571 defines a basic file service. It provides sufficient facilities to support file transfer, and establishes a framework for file access and file management. ISO 8571 does not specify the interfaces to a file transfer or access facility within the local system.

ISO 8571 consists of the following four parts:

Part 1: General introduction
Part 2: Virtual Filestore definition
Part 3: File Service definition
Part 4: File Protocol specification

This part of ISO 8571 contains the following annexes which form part of the standard:

Annex A - Protocol State Tables;
Annex B - Reference to FTAM PDU Definitions;

and the following annex which does not form part of the standard:

Annex C - ASN.1 cross reference.

1 Scope

ISO 8571-4 consists of four main sections:

a) the basic protocol (in sections two and three), which supports the internal file service;

b) the error recovery protocol (in section four), which supports the external file service.

For each of these, ISO 8571-4 includes a formal statement of the nature of the automaton giving the necessary behaviour of each of the participating entities. It states:

1) the actions to be taken on receiving request and response primitives issued by a file service user;

2) the actions to be taken on receiving indication and confirm primitives issued by the Presentation Service provider;

3) the actions to be taken as a result of events within the local system.

c) the definition (in section five) of the abstract syntax required to convey the file protocol control information.

d) the conformance requirements to be met by implementors of this protocol (in section six).

The scope of the File Protocol is limited to the interconnection of systems; it does not specify or restrict the possible implementation of interfaces within a computer system.

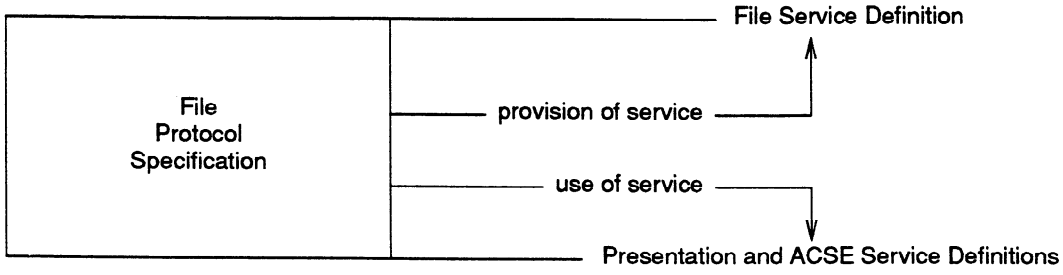

Figure 1 — Relationship between file protocol and service definitions

2 Field of application

The purpose of ISO 8571-4 within the OSI scheme is to specify the behaviour which must be exhibited by a system in order to take part in the provision of the file transfer access and management service.

The file protocol specification references three service definitions in order to express the environment within which it is applied. ISO 8571-3 defines the aims and objectives that the protocol must achieve. The Presentation Service (ISO 8822) and ACSE Service (ISO 8649-2) define the set of assumptions about the supporting facilities which the protocol may exploit (see figure 1).

3 References

ISO 7498, *Information Processing Systems - Open Systems Interconnection - Basic Reference Model*

ISO 7498-3, *Information Processing Systems - Open Systems Interconnection - Basic Reference Model*
- Part 3: Naming and Addressing

ISO 8326, *Information Processing Systems - Open Systems Interconnection - Basic Connection Oriented Session Service Definition.*

ISO 8571, *Information processing systems - Open systems interconnection - File transfer, access and management.*
- Part 1: General introduction.
- Part 2: Virtual Filestore definition.
- Part 3: File Service definition.

ISO 8649, *Information Processing Systems - Open Systems Interconnection - Service definition for the Association Control Service Element.*

ISO 8650, *Information Processing Systems - Open Systems Interconnection - Protocol specification for the Association Control Service Element.*

ISO 8822, *Information Processing Systems - Open Systems Interconnection - Connection-oriented Presentation Service Definition.*

ISO 8824, *Information Processing Systems - Open Systems Interconnection - Specification of Abstract Syntax Notation One (ASN.1).*

ISO 8825, *Information Processing Systems - Open Systems Interconnection - Specification of basic encoding rules for Abstract Syntax Notation*

4 Definitions and abbreviations

Terms and abbreviations are defined in ISO 8571-1. The definitions of service primitive names and service state names given in ISO 8571-3 are also used in this part of ISO 8571.

Section one: General

5 Overview of the file protocol

5.1 Service supported by the file protocol

ISO 8571-4 specifies the following protocols which support the file services defined in ISO 8571-3:

a) the basic protocol (see sections two and three), which supports the internal file service;

b) the error recovery protocol (see section four), which supports the external file service.

5.2 Services assumed by the basic file protocol

The file protocol specified in this part of ISO 8571-4 assumes the use of the services listed in table 1. These are Presentation Services as defined in ISO 8822 and ACSE Association Control Services defined in ISO 8649. The OSI Reference Model allows the use of FTAM as one component in a distributed application; the specification of such an application before and after the FTAM regime is outside the scope of ISO 8571-4.

The assumptions made in different file protocol functional units (see 5.6) are listed separately.

5.3 Functions provided

5.3.1 Functions in the basic protocol

The basic protocol supports the internal file service (see ISO 8571-1), using the ACSE and Presentation Services. It supports the following functions:

a) representation of the internal file service primitives as a sequence of protocol data units for transmission by the ACSE and Presentation Services;

b) grouping, when appropriate, of the representations of logically separate service primitives as distinct data values in a single P-DATA request service primitive;

c) ensuring the progress of the protocol.

5.3.2 Functions in the error recovery protocol

The error recovery protocol supports the external service (see ISO 8571-1), using the internal file service. It supports the following functions:

a) management of error recovery information during the normal operation of the file service;

b) restart of data transfer after interruption within the data transfer regime;

c) recovery from abnormal termination of the file open or file selection regime.

d) recovery from abnormal termination which destroys the internal file service regime.

5.4 Model used

In abstract, the operation of the protocol is modelled by the interaction of two file protocol machines (FPMs). The two FPMs communicate by means of the services available at their lower boundary, in such a way as to provide the services required at their upper boundary. These concepts are illustrated in figure 2.

The file service is defined asymmetrically with the file service user "A" being the initiator and file service user "B" being the responder.

The behaviour of each FPM is defined in terms of:

a) the actions it takes:

1) issue of indication or confirm service primitives to the upper service user;

2) issue request or response service primitives to the lower service provider;

b) the stimuli it receives:

1) receipt of request or response service primitives from the upper service user;

2) receipt of indication or confirm service primitives from the lower service provider;

Table 1 — Presentation and Session Services required by FTAM Functional Units

FTAM Functional Unit	Session Functional Unit	Presentation Functional Unit
Kernel(4)	Kernel Duplex Optionally: Resynch(1) Minor synch(2)	Kernel Duplex Optionally: Resynch(1) Minor synch(2) Context Management(3)
Recovery	Minor Synch	Minor Synch
Restart	Minor Synch Resynchronize	Minor Synch Resynchronize

NOTES

1 The resynchronize functional units shall be used if available.

2 Minor synch is required whenever the resynchronize functional unit is available. The presence of a confirmed minor synchronization point at the start of the bulk data regime is used to limit the destructive effects of resynchronization until after the regime has been fully established.

3 Use of the optional context management presentation functional unit implies the use of the typed data session functional unit.

4 The other functional units visible in the external service have the same presentation and session requirements as the kernel functional unit.

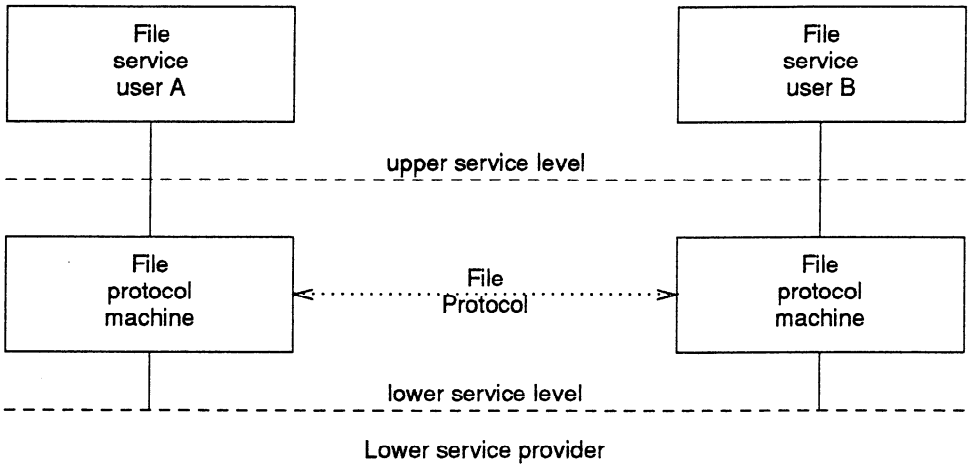

Figure 2 — File Protocol Machine model

3) local error indications;

4) management intervention.

c) the information available:

1) information associated with the lower service association endpoint; this information is lost if the lower service association ceases to exist;

2) information associated with the upper service association endpoint; in the error recovery protocol procedures are provided for recovery on loss of the lower service association, based on the information associated with the two upper service association endpoints.

NOTES

1 For the basic protocol, the lower boundary service is the composite of ACSE and presentation service and the upper boundary service is the internal file service.

2 For the error recovery protocol, the lower boundary service is the internal file service and the upper boundary is the external file service.

3 The information describing the upper service association in the external file service is preserved across system failures, and so is available to allow meaningful recovery.

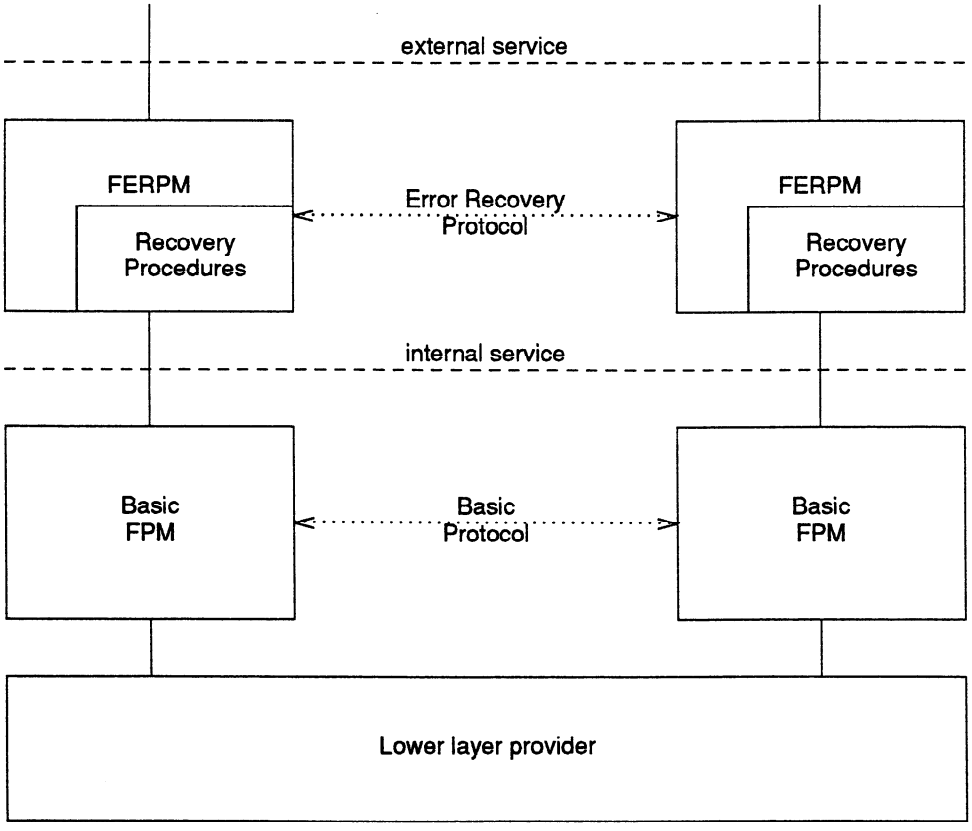

Figure 3 — Extended File Protocol Machine model

5.5 Correspondence between service primitive names and FPDU names

FPDUs which are sent as a result of a service primitive issued by a user of the supported service have the same name as that service primitive.

Examples:

Service primitive	FPDU
F-INITIALIZE request	F-INITIALIZE request FPDU
F-INITIALIZE response	F-INITIALIZE response FPDU

NOTES

1 Receipt of these FPDUs is signalled to the service user as F-INITIALIZE indication service primitives and F-INITIALIZE confirm service primitives respectively.

2 In some cases, several FPDUs may be grouped into a single PSDU. There is not therefore always a one-to-one correspondence between file service primitives and lower layer service primitives.

5.6 Protocol functional units

The functional units of the file protocol are equivalent to the functional units of the supported service:

a) kernel functional unit;
b) read functional unit;
c) write functional unit;
d) file access functional unit;
e) limited file management functional unit;
f) enhanced file management functional unit;
g) grouping functional unit;
h) FADU locking functional unit;
i) recovery functional unit;
j) restart functional unit.

NOTES

1 Each FPDU in a file protocol functional unit corresponds to the equivalent service primitive in the equivalent service functional unit.

2 Negotiation of a service functional unit implies the negotiation of the equivalent protocol functional unit.

Section two: Basic file protocol

6 State of the association provided

NOTE - The entities referred to in this section are basic protocol entities.

6.1 Operation of the protocol

The required behaviour of an entity conforming to the basic file protocol is expressed in the following clauses, in terms of the actions to be taken in response to each possible stimulus. Each clause is labelled with the name of the functional unit to which it applies, and the actions in a clause shall not apply if that functional unit is not successfully negotiated.

In specifying responses to service primitives issued by the IFS user, it is assumed that each type of service primitive shall only be received when the association endpoint is in a state in which the file service allows it to be received. Checking that this is the case is a matter of local interface organization.

For each PDU that may be received, the specification enumerates the states of the protocol in which the receiving entity can receive the PDU. If the action specified on receipt of a stimulus would require the issue of a service primitive which could not validly be issued in the current state, the entity concerned shall indicate a protocol error (see 10.2). If a PDU or a presentation service primitive is received under circumstances not enumerated, a protocol error has occurred. If a PDU or presentation service primitive is received that contains parameters with values inconsistent with previous values negotiated or requested during negotiation, then a protocol error has occurred.

6.2 Additional state information

The following sub-clauses define further state information associated with the basic protocol entities.

6.2.1 Expected responses list

The expected responses list records the original state and the operations remaining outstanding during a grouped exchange of PDUs and services (see 8.11, 8.12, 9.11 and 9.12). The expected responses list is an ordered list or "first in/first out queue" and holds the names of successive pending PDUs or primitives during use of the grouping mechanism. Initially the list is empty.

6.2.2 Initial state indicator

The initial state indicator records the state of the entity on invocation of the grouping mechanism. The defined values are the names of the states defined in ISO 8571-4 and "unset". Initially the value is "unset".

6.2.3 Next state indicator

The next state indicator records the next logical regime implied by receipt of grouped responses. The defined values are the state names "initialized", "selected" and "data transfer idle", and "unset". Initially the value is unset.

6.2.4 P-alter indicator

The p-alter indicator is used to record the need for additional alteration of the defined context set. The defined values are "unset" and "set". Initially, the value is "unset".

6.2.5 Bulk data transfer number

The bulk data transfer number identifies the bulk data transfers within an open regime. It is an integer in the range 0 to 999 999. Initially, the value is 0.

NOTE - The use of pieces of state information associated with an entity as an aid to specification does not imply that any distinct realization of such information is required within an entity.

7 File protocol data units

The file PDUs are complex data types defined by an abstract syntax definition (clause 20). This definition includes named parameters corresponding to those parameters in the file service carried directly by FTAM-PCI and those parameters necessary for the operation of the protocol.

For information which is always required default values are defined to avoid unnecessary overhead. The transfer syntax of these data types is negotiated and encoding performed by the presentation service provider.

The PDUs are transmitted as data values, either on a P-DATA primitive or in the user information of a ACSE primitive or in the user data of a Presentation Service primitive. The possible means of transmission of each PDU are listed in tables 2 and 3. (The means of transmission of the bulk data transfer PDUs are listed in table 5.) The PDUs marked with a * in the tables are carried on the response and confirm service primitives. All others are carried on request and indication service primitives.

Table 2 — Protocol Data Units, FTAM regime establishment

Name	Carried by	Functional units
F-INITIALIZE request	A-ASSOCIATE	kernel
F-INITIALIZE response*	A-ASSOCIATE	kernel
F-TERMINATE request	A-RELEASE	kernel
F-TERMINATE response*	A-RELEASE	kernel
F-P-ABORT request	A-ABORT	kernel
F-U-ABORT request	A-ABORT	kernel

Table 3 — Protocol data units, File regime control

Name	Carried by	Functional units
F-SELECT request	P-DATA	kernel
F-SELECT response	P-DATA	kernel
F-DESELECT request	P-DATA	kernel
F-DESELECT response	P-DATA	kernel
F-CREATE request	P-DATA	limited file management
F-CREATE response	P-DATA	limited file management
F-DELETE request	P-DATA	limited file management
F-DELETE response	P-DATA	limited file management
F-READ-ATTRIB request	P-DATA	limited file management
F-READ-ATTRIB response	P-DATA	limited file management
F-CHANGE-ATTRIB request	P-DATA	enhanced file management
F-CHANGE-ATTRIB response	P-DATA	enhanced file management
F-OPEN request	P-DATA	read, write
F-OPEN response	P-DATA	read, write
F-CLOSE request	P-DATA	read, write
F-CLOSE response	P-DATA	read, write
F-BEGIN-GROUP request	P-DATA	grouping
F-BEGIN-GROUP response	P-DATA	grouping
F-END-GROUP request	P-DATA	grouping
F-END-GROUP response	P-DATA	grouping
F-RECOVER request	P-DATA	recovery
F-RECOVER response	P-DATA	recovery
F-LOCATE request	P-DATA	access
F-LOCATE response	P-DATA	access
F-ERASE request	P-DATA	access
F-ERASE response	P-DATA	access

A P-DATA primitive conveys a series of data values. This series of data values is referred to in ISO 8571 as a Presentation Service Data Unit (PSDU). The protocol specifies, in terms of the circumstances in which the sequence of data values in a PSDU is terminated, the exact contents of each P-DATA issued. The series of data units may not be divided into several P-DATA primitives in ways not specified by this protocol.

File PDUs are transmitted in one particular presentation context, called the FTAM-PCI context. This is defined to be the context used for the user information data value of the ACSE A-ASSOCIATE primitive, and shall be a context corresponding to the FTAM-PCI abstract syntax defined in ISO 8571-4.

NOTE - Data values in any other context are not File PDUs and this fact is used to ensure the transparency of user data.

The receiver recognizes PDUs on the basis that a File PDU shall:

a) be transmitted in the FTAM-PCI context,

b) consist of a single complete value from the FTAM-PCI abstract syntax.

NOTE - A data value which differs in any material way, either by omission of a mandatory parameter, or by addition of an undefined parameter, or by use of an invalid parameter value, from the defined values of the File PDU data types is not a File PDU.

An entity shall signal a protocol error (10.2) if:

c) it receives any ACSE or presentation service primitives not specified for the functional units negotiated;

d) it receives a sequence of data values in the FTAM PCI context which does not form a defined PDU.

e) it receives any PDU which does not belong to the selected functional units.