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AMENDMENT 4
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Information processing systems – Open Systems Interconnection – File Transfer, Access and Management –

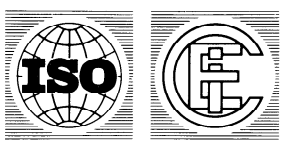
Part 4:
File Protocol Specification

AMENDMENT 4

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

AMENDEMENT 4



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Foreword

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Amendment 4 to International Standard ISO 8571-4:1988 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology.*

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*
- *Part 5: Protocol Implementation Conformance Statement Proforma*

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

Part 4:
File Protocol Specification

AMENDMENT 4

Page 6

Remove subclause 6.2.4.

Page 7

Modify the last sentence of clause 7 paragraph 4 to read "The series of *file protocol* data units may not be divided..."

Page 9

Add the following to subclauses 8.3.1 and 8.3.2 after the word "initialized":

> "..., where the *requested access* refers to a subset of the actions requested by the *service class* and *functional units* negotiated at initialization,..."

Page 10

Remove from 8.3.3 the following:

> "...where the requested access must refer to a subset of the actions requested,..."

Page 12

Remove subclause 8.9.3 item b.

Replace subclause 8.9.3 item c with the following text:

"If the presentation action parameter is false, issue an F-OPEN confirm primitive to the IFS user, with parameters derived from the data values received, and enter the state "data transfer idle"."

Replace subclause 8.9.3 item d with the following text:

"If the presentation action parameter is true, preserve the PDU for further processing and enter state "p-alter context pending"."

Remove subclause 8.9.4 item a.

Replace subclause 8.9.4 item b with the following text:

"If the presentation action parameter is false, issue an F-OPEN confirm primitive to the IFS user, with parameters derived from the data values received;"

Replace subclause 8.9.4 item d with the following text:

"If the PDU did not carry a state result indicating failure and if the presentation action parameter is true, preserve the PDU for further processing;"

Change the last sentence of 8.9.5 first paragraph from:

"...in the state "p-alter context pending" and the p-alter indicator is set, the entity shall:..."

to:

"...in the state "p-alter context pending" and the presentation context management functional unit is available and there are presentation contexts to be deleted or defined, the entity shall:..."

Add the word "Construct" at the beginning of 8.9.5 a). "Construct a presentation..."

Remove subclause 8.9.5 item d.

Change the last sentence of 8.9.6 first paragraph from:

"...in the state "p-alter context pending" and the p-alter indicator is unset, the entity shall:..."

to:

"...in the state "p-alter context pending" and the presentation context management functional unit is available or there are no presentation contexts to be deleted or defined, the entity shall:..."

Page 13

Remove subclause 8.13.2 item b.

Page 14

Replace subclause 8.13.2 item c with the following text:

> "If the presentation action parameter is false, issue an F-RECOVER confirm primitive to the IFS user, with parameters derived from the data values received, and enter the state "data transfer idle recover"."

Replace subclause 8.13.2 item d with the following text:

> "If the presentation action parameter is true, preserve the PDU for further processing and enter the state "p-alter context pending"."

Change the last sentence of 8.13.3 first paragraph from:

> "...in the state "p-alter context pending" and the p-alter indicator is set, the entity shall:..."

to:

> "...in the state "p-alter context pending" and the presentation context management functional unit is available and there are presentation contexts to be deleted or defined, the entity shall:..."

Remove subclause 8.13.3 item d.

Change the last sentence of 8.13.4 first paragraph from:

> "...in the state "p-alter context pending" and the p-alter indicator is unset, the entity shall:..."

to:

> "...in the state "p-alter context pending" and the presentation context management functional unit is unavailable or there are no presentation contexts to be deleted or defined, the entity shall:..."

Page 18

Replace "current PDU" with "current PSDU" in subclause 9.10.4 item a.

Page 19

Replace "F-RECOVER response primitive" with "F-RECOVER response service primitive" in subclause 9.13.2 item e.

Page 20

Replace "an action result parameter" with "a diagnostic parameter" in subclause 10.2 item a.

Page 21

Replace "presentation" with "Presentation" and "session" with "Session" in subclause 11.2.2 second sentence.

Replace "session" with "Presentation" and "presentation" with "Presentation" in subclause 11.2.4

Page 22

Replace "next resynchronization point number" with "next synchronization point number" in subclause 11.2.5 at the end of the first paragraph.

Replace "presentation" with "Presentation" in subclause 11.2.5.

Replace "next synchronization point serial number" with "next synchronization point number" in subclause 13.1.2 b).

Page 24

In subclauses 15.1.2 and 15.2.2 replace "P-SYNCH-MINOR" with "P-SYNC-MINOR".

Replace "next synchronization point serial number" with "next synchronization point number" in subclause 15.3.1 item e.

Replace both occurrences "next synchronization point serial number" with "next synchronization point number" in subclause 15.3.1 item f.

Replace "synch point serial number" with "synchronization point serial number" in subclause 15.3.2 item b.

Page 25

Replace "next synchronization point serial number" with "next synchronization point number" in subclause 16.3.1 item c.

Replace "next synchronization point serial number" with "next synchronization point number" in subclause 16.3.1 item g.

Replace "synch point serial number" with "synchronization point serial number" in subclause 16.3.2 item b.

Replace "expected synchronization number" with "next synchronization point number" in subclause 17.2.5 item b.

Page 26

Replace "synchronization point number" with "synchronization point serial number" and replace "next resynchronization point serial number" with "next synchronization point number" in the last sentence of the paragraph in subclause 17.3.1.

Replace "resynchronization point number" with "synchronization point serial number" in subclause 17.3.3 item c.

Replace "resynchronization point number" with "synchronization point serial number" in subclause 17.3.4 item d.

Replace "resynchronization point number" with "synchronization point serial number" in subclause 17.3.5 item e.

Page 27

Replace "indication Permanent" with "indication. Permanent" in subclause 18.1.3 last paragraph.

Page 28

In subclause 19.1.1 item a replace "carrying" with "not carrying".

Add "d) issue an F-INITIALIZE request to the IFS provider." to subclause 19.1.2.1.1.

Page 29

In subclause 19.1.4 paragraph change the word "when" to "while".

Replace "F-INITIALIZE request" with "F-INITIALIZE response" in subclause 19.1.5.3.

Replace "FERPM and shall retain" with "FERPM shall retain" in subclause 19.1.5.4.

Page 30

In subclause 19.2.1 first sentence position the sentence after figure 4.

Replace subclause 19.2.1.3 with the following:

> "If the entity is a sending entity, the F-RESTART request shall include the last acknowledged point as a recovery point."

Replace "Write or Read procedure" with "Read or Write procedure" in figure 5.

Replace ", it shall discard the primitive." with ", it shall decide that it is a collision-loser in the Session layer and shall send an F-RESTART response as a response to the F-RESTART indication." in the last sentence of subclause 19.2.1.7.

Page 31

In 19.2.3.4 c) replace the words:

> "and an F-U-ABORT request to the internal file service provider, with a diagnostic..."

by the words:

> "and locally signal the internal file service provider to issue a F-P-ABORT PDU with a diagnostic..."

Page 33

Add the following comments in the ASN.1 (subclause 20.3):

> Insert after lines 29 and 45 the following:
>
> > "– If the recovery of restart data transfer functional units are not available, the checkpoint window parameter shall not be sent."

Page 37

Insert after line 255 the following:

> "– If the fadu-locking functional unit is not available, the enable-fadu-locking parameter shall not be sent."

Change line 260 from "at-start-of-file" to "at-start-of-transfer".

Insert after line 275 the following:

> "– If the recovery or restart data transfer functional unit are not available, the recovery-mode parameter shall not be sent."

Page 38

Insert after lines 309 and 319 the following:

> "– The recovery-point parameter shall only be sent by the entity that was receiving data at the time of failure."

Page 40

Add an ASN.1 note in subclause 20.3 after line 470 stating "– At least one attribute parameter shall be present in Change Attributes on the request PDU".

Page 43

Add a note after line 654 of figure 11:

"– in the case where the parameter is a null list, "NULL" shall be
– – explicitly encoded."

Page 45

Add a new subclause 20.5 titled "Rules of extensibility" with the following text:

> "For the F-INITIALIZE request FPDU, a receiving Responder FPM shall:
> a) ignore any undefined element;
> b) where named bits are used in subclause 20.3, treat any as insignificant when no name is assigned to it.

Pages 47 to 85

Replace annex A with the attached text.

The following subclauses have been amended:

A.1.1, A.1.2, A.1.6, A.1.7, A.2.4, A.2.7, A.2.9, A.3.4, A.3.5, A.3.9, A.4.4, A.4.6, A.4.7, A.4.8, A.4.9, A.5.2.1, A.5.2.2, A.5.2.3, A.5.3.1, A.5.3.2, A.5.3.3, A.5.4, A.5.5, A.5.6, A.5.7, A.5.8, A.5.9, A.5.11, A.5.12, A.5.13, A.5.15 and A.5.17.

Annex A
Protocol state tables

(This annex forms part of the standard.)

A.1 Introduction

In the event of a discrepancy becoming apparent in the protocol described in the body of this standard and the protocol described in this Annex, this Annex is to take precedence.

These tables describe the operation of the basic file protocol machine (FPM) and error recovery protocol machine (FERPM).

The basic protocol tables are divided into three groups, covering:

a) the FTAM regime management protocol machine;

b) the file regime management protocol machine;

c) the bulk data transfer protocol machine.

The initial and final states of the file regime management protocol machine are also states of FTAM regime management protocol machine. The initial and final states of the bulk data transfer protocol machine are also states of the file regime management protocol machine.

To provide formally complete and consistent description of the FTAM protocol sequences of events are considered indivisible in the model. That indivisibility ensures both that the states used in the description are well defined and that they are sufficient to describe the protocol.

The reception of a service primitive and the generation of dependent actions are considered to be an indivisible action. The reception of an FPDU and the generation of dependent actions are considered to be an indivisible action.

The indivisibility of actions may, in some implementations, cause certain events from file service users to be invalid at some service interface.

The conventions adopted in this Annex are described below.

A.1.1 System model used for protocol description

There are four types of receivers and sources of incoming and outgoing events (see figure 12):

a) The internal file service user, which is the file error recovery protocol machine (FERPM);

b) The external file service user — initiator or responder;

c) The local system environment;

d) the underlying presentation and ACSE service providers.

All primitives to/from the external file service user are passed through as primitives to/from the internal file service user to the basic FPM.

If the FERPM is not null — that is, either the RESTART or the RECOVER functional unit is available — parameters needed for error control and recovery may be added to these primitives.

Signals to/from the local environment group together events signalling errors and events signalling interactions amongst the FERPM, its docket and its local system. These local signals are

e) L-ERRABT — local signal indicating protocol or other local errors leading to F-P-ABORT, with a permanent error value in the action result parameter;

f) L-PABORT — local signal indicating that a F-P-ABORT request PDU with a transient error value in the action result should be issued;

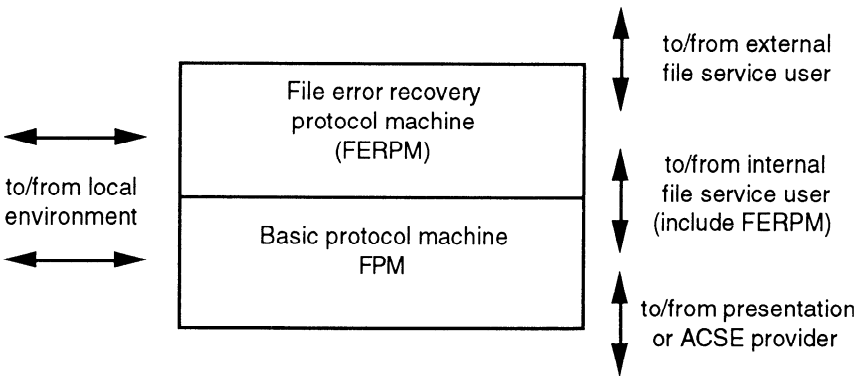

Figure 12 — State machine system model

g) L-ERROR1, L-ERROR2 and L-ERROR3 — local signals indicating class I, class II and class III errors respectively;

h) L-SUSPND — a local signal sent by the sender in the RESTART state to the local system to suspend the issuing of F-DATA request and F-DATA-END request primitives;

i) L-RESUME — a local signal to the local system to resume the issuing of F-DATA request and F-DATA-END request primitives when a sender has completed its recovery from RESTART and is now back in DATA-XFER state;

j) L-RESEND — a local signal from the FERPM to the sending local system. This signal includes the negotiated restart checkpoint and eliminates the need to store data values in the docket. Upon receipt of this local signal the local system can either

1) resend data from the checkpoint if the local system is aware of the algorithm used by the FERPM to generate the checkpoint; or

2) resend data from the start of the file if it has no knowledge of the checkpoint generating algorithm. The FERPM in the RESTART state will discard all data from the local system that occurs before the negotiated checkpoint. The FERPM will only forward data past the negotiated checkpoint to the FPM;

k) L-DATRQ — signal representing a re-issued F-DATA request primitive from the local system;

l) L-DAERQ — signal representing a re-issued F-DATA-END request primitive when a "data-end" marker becomes available from the docket;

m) L-CHKRQ — signal representing a re-issued F-CHECK request primitive when a checkpoint identifier becomes available from the docket;

n) L-EORIN — end of restart indication signal indicating that all checkpoint identifiers, "data-end" markers are all data to be resent have been sent;

o) L-GIVEUP — signal indicating that the responding FERPM should abandon the recovery process. This is introduced so that if the initiating FERPM is unable to re-establish the association then the responding FERPM can inform its users of the irrecoverable error.

p) L-ERRCTX — signal indicating that the P-ALTER-CONTEXT negotiation is unsuccessful. The error is to be processed following the F-OPEN or F-RECOVER confirm as applicable.

q) L-HOLD — signal to FERPM to hold any primitive from the external user for later processing.

r) L-UNHOLD — signal to FERPM to process any previously held primitives.

s) L-STPSND --- a local signal from the FERPM to the sending local system to stop the resending of data and checkpoints.

A.1.2 Incoming Events

The receipt of sequences of service events are assumed to be permissible in accordance with those defined in ISO 8571-3.

Events in the tables are depicted by abbreviated names. A list of these abbreviations, arranged alphabetically within categories, precedes each table. Wherever possible, these events have been arranged in the order in which a normal error-free sequence of events would occur.

It is assumed that incoming PDUs have been extracted from the user data fields of Presentation or ACSE indication or confirm primitives prior to being considered as incoming events.

The following naming conventions are used:

a) The prefix "F-" (as in F-INIRQ) indicates a primitive issued by the external file service (EFS) user or issued by the FERPM to the EFS user;

b) The prefix "P-" (as in P-ALTRQ) indicates a primitive issued by the Presentation Service (PS) provider.

c) The prefix "A-" (as in A-PABIN) indicates a primitive issued by the ACSE provider;

d) The prefix "L-" (as in L-ERRABT) indicates a local signal from the FPM or the FERPM to the local system or from the local system environment to the FPM or the FERPM;

e) The prefix "I-" (as in I-OPNRQ) indicates a primitive issued by the FERPM to the FPM or vice-versa;

f) Where no prefix is used, the event is the receipt of an FTAM PDU or, in the case of GRPRQ and GRPRP, a grouped sequence of PDUs. The only exception is "DATIN" which indicates a data value in user context in the data transfer state.

g) The following suffices indicate the basic types of primitives and PDUs:

"RQ"	request
"IN"	indication
"RP"	response
"CF"	confirm

A.1.3 Outgoing Events

The same naming conventions are used for outgoing events as for incoming events. Where the outgoing event is the issue of a PDU, it will normally give rise to the similarly named incoming event for the other protocol entity. For example, the outgoing event SELRP of the responding entity will become the incoming event SELRP for the initiating entity.

A.1.4 States

The suffix "-PD" indicates a pending state, waiting for some known primitive or PDU type. The suffix "-EX" indicates an expectant state in FERPM, waiting for some expected primitive.

The prefix "P-" normally indicates waiting for a primitive from the Presentation Service provider. Similarly, the

prefix "F-" indicates waiting for a primitive from the EFS user. If neither of the above prefices is used, the state normally indicates waiting for a PDU, or a non-pending state.

A.1.5 Predicates

The following symbols used in predicates have their normal Boolean algebraic meanings:

&	AND
|	OR
~	NOT

An incoming event may satisfy more than one predicate, in which case the conditional actions for satisfied predicates will be executed.

Some actions may be conditional upon the negotiation of particular service functional units;

those in the FPM are:

U1:	Kernel functional unit
U2:	Read functional unit
U3:	Write functional unit
U4:	File access functional unit
U5:	Limited management functional unit
U6:	Enhanced management functional unit
U7:	Grouping functional unit
U8:	FADU locking functional unit

those in the FERPM are:

U9:	Recovery functional unit
U10:	Restart data transfer functional unit

A.1.6 Actions

Actions may be conditional on specified predicates, or they may be unconditional. When a line in a "detailed entries" specification commences with a predicate specifier followed by a colon, this indicates that all actions on that line are conditional upon the indicated predicate. An action may consist of one or more of the following:

a) an outgoing event, indicated by its abbreviated name;

b) a specified action, indicated by a number in square brackets [ ] and separated from any preceding items by a comma;

c) a specified qualifier, indicated by a number in square brackets [ ] following a preceding item without a intervening comma;

Actions are qualifiers are described in a single list preceding the table.

The next state which the protocol entity will enter is indicated by an arrow preceding a state name, e.g. "⇒ SELECTED". For the null transition back to the current state, the notation "⇒ *same state*" is used.

Once a state change occurs, all subsequent actions in that entry are ignored.

A.1.7 Implicit Action

The following entity actions have not been explicitly specified in the State tables, but constitute part of the entity behaviour:

a) A blank square in the table indicates an invalid event.

b) Unless otherwise stated in the tables, an invalid event would cause the action specified in 10.2 to be executed.

c) The Presentation Service is used throughout to identify "active" FTAM PCI from data with an equivalent encoding, but in a "passive" use data context.

d) For each incoming PDU, a check is made that the appropriate functional unit has been negotiated for the connection. If the check fails, the procedures for protocol violation specified in 10.2 are followed.

e) For each incoming PDU the permissible sequences of service events as defined in ISO 8571-3 shall be checked. If the check fails the procedures for protocol violation specified in 10.2 are followed.

A.1.8 Additional State Information

The tables make use of the indicators and other state variables defined in 6.2 and 11.2. In addition, the file regime management tables for the initiator make use of a threshold indicator and an expected response list, as a means of specifying the entity state when a concatenated PDU group is outstanding.

The symbol NSPN is used to denote the Next Synchronization Point Number state variable.

A.2 FTAM regime management protocol machine (Kernel functional unit)

A.2.1 States — FTAM regime management

UNINITIALIZED	FTAM regime ended.
INITIALIZE-PD	Initialize pending; wait for initialize response PDU.
INITIALIZED	FTAM regime started.
TERMINATE-PD	Terminate pending; wait for terminate response PDU.
I-INITIALIZE-PD	Initialize pending; wait for F-INITIALIZE response primitive from the internal file service user.
I-TERMINATE-PD	Terminate pending; wait for F-TERMINATE response primitive from the internal file service user.
ANY-OTHER	Any other state of the file regime management protocol machine or the bulk data transfer protocol machine.

A.2.2 Incoming events — FTAM regime management

In the following lists, the functional unit in which the event occurs is included after the name, where applicable.

A.2.2.1 Incoming events — PDUs

UABRQ	U-Abort request PDU (on A-ABORT indication primitive)	U1
PABRQ	P-Abort request PDU (on A-ABORT indication primitive)	"
INIRQ	Initialize request PDU	"
INIRP	Initialize response PDU	"
TERRQ	Terminate request PDU	"
TERRP	Terminate response PDU	"

A.2.2.2 Incoming events from the internal file service user

I-UABRQ	F-U-ABORT request primitive
I-INIRQ	F-INITIALIZE request primitive
I-INIRP	F-INITIALIZE response primitive
I-TERRQ	F-TERMINATE request primitive
I-TERRP	F-TERMINATE response primitive

A.2.2.3 Incoming events from the ACSE provider

A-PABIN	A-P-ABORT indication primitive
A-ABIN	A-ABORT indication primitive without user data
A-ASSCF	A-ASSOCIATE confirm primitive without user data (with result indicating reject by ACSE or presentation service provider)

A.2.2.4 Incoming events from the local system

L-ERRABT	Local signal indicating error leading to abort
L-PABORT	Local signal indicating that a F-P-ABORT request PDU and a F-P-ABORT indication primitive to the internal file service user, both with a transient error value.

A.2.3 Outgoing events — FTAM regime management

A.2.3.1 Outgoing events — PDUs

UABRQ	U-Abort request PDU
PABRQ	P-Abort request PDU

INIRQ	Initialize request PDU
INIRP	Initialize response PDU
TERRQ	Terminate request PDU
TERRP	Terminate response PDU

A.2.3.2 Outgoing events to the internal file service user

I-UABIN	F-U-ABORT indication primitive
I-PABIN	F-P-ABORT indication primitive
I-INIIN	F-INITIALIZE indication primitive
I-INICF	F-INITIALIZE confirm primitive
I-TERIN	F-TERMINATE indication primitive
I-TERCF	F-TERMINATE confirm primitive

A.2.4 Specific actions — FTAM regime management

[1] Send the PDU constructed as user data and map parameters on the appropriate ACSE form.

[3] Initialize state information - unset all additional state information indicators, set outstanding checkpoint counter to zero, NSPN to one.

[4] Set state result parameters to "success".

[5] In case of ACSE provider abort, if any diagnostic indicates communications failure then set the action result to transient error.

[6] Set state result parameter to "failure".

[7] Record the FQOS required and select the restart and/or recovery functional units if necessary.

[12] Establish the list of presentation contexts needed to support FTAM PCI and ACSE PCI abstract syntaxes. If necessary, determine, on the basis of the abstract syntaxes derived from the contents type list supplied by the external file service user, the list of presentation contexts needed to support the file contents, and add it to the previous list. The resultant list is used to construct the presentation context definition list parameter.

[13] Update the value of the contents type list parameter in the F-INITIALIZE indication primitive issued to the internal file service user, according to the abstract syntaxes rejected by the presentation service provider, if necessary.

[14] According to the value of the contents type list on the F-INITIALIZE response primitive received from the internal file service user, construct the presentation context definition result parameter.

[20] Set the action result parameter according to the result parameter of the A-ASSOCIATE confirm service primitive.

[62] Record the peer entity's checkpoint window.

[80] Set action result to permanent error

[81] Set action result to transient error

A.2.5 Predicates — FTAM regime management

P1: I-INITIALIZE request primitive is acceptable.

P2: Result parameter of the ACSE confirm primitive indicates success of the operation.

P3: State result parameter of the incoming response primitive indicates success of the operation.

P5: Initialize request PDU is acceptable.

P25: Negotiable parameters have values consistent with request.

A.2.6 Initiating entity state table — FTAM regime management

STATE / EVENT	UNINITIALIZED	INITIALIZE-PD	INITIALIZED	TERMINATE-PD	ANY-OTHER
I-INITRQ	1				
A-ASSCF		10			
INIRP		2			
I-TERRQ			3		
TERRP				4	
A-PABIN		5	5	5	5
A-ABIN		7	7	7	7
UABRQ		6	6	6	6
PABRQ		7	7	7	7
I-UABRQ		8	8	8	8
L-ERRABT		9	9	9	9
L-PABORT		11	11	11	11

A.2.7 Initiating entity state table: detailed entries

1:	P1:	[3],[12],INIRQ[1]	⇒ INITIALIZE-PD
	~P1:	I-INICF[6]	⇒ *same state*
2:	P3&P2 & P25:	[62],I-INICF[4],[7]	⇒ INITIALIZED
	P3&P2 & ~P25:	I-INICF[6],PABRQ[1]	⇒ UNINITIALIZED
	~P2:	I-INICF[6]	⇒ UNINITIALIZED
	~P3:	PABRQ[1],I-PABIN[80]	⇒ UNINITIALIZED
3:		TERRQ[1]	⇒ TERMINATE-PD
4:		I-TERCF	⇒ UNINITIALIZED
5:		I-PABIN[81]	⇒ UNINITIALIZED
6:		I-UABIN	⇒ UNINITIALIZED
7:		I-PABIN	⇒ UNINITIALIZED
8:		UABRQ[1]	⇒ UNINITIALIZED
9:		PABRQ[1],I-PABIN[80]	⇒ UNINITIALIZED
10:		I-INITCF[6],I-PABIN[20]	⇒ UNINITIALIZED
11:		PABRQ[1],I-PABIN[81]	⇒ UNINITIALIZED

A.2.8 Responding entity state table — FTAM regime management

STATE / EVENT	UNINITIALIZED	I-INITIALIZE-PD	INITIALIZED	I-TERMINATE-PD	ANY-OTHER
INIRQ	1				
I-INIRP		2			
TERRQ			3		
I-TERRP				4	
A-PABIN		5	5	5	5
A-ABIN		7	7	7	7
UABRQ		6	6	6	6
PABRQ		7	7	7	7
I-UABRQ		8	8	8	8
L-ERRABT		9	9	9	9
L-PABORT		11	11	11	11

A.2.9 Responding entity state table: detailed entries

1:	P5:	I-INIIN,[3],[62],[13]	⇒ I-INITIALIZE-PD
	~P5:	INIRP[6][1]	⇒ *same state*
2:	P3:	[7],[14],INIRP[1]	⇒ INITIALIZED
	~P3:	INIRP[6][1]	⇒ UNINITIALIZED
3:		I-TERIN	⇒ I-TERMINATE-PD
4:		TERRP[1]	⇒ UNITIALIZED
5:		I-PABIN[81]	⇒ UNITIALIZED
6:		I-UABIN	⇒ UNITIALIZED
7:		I-PABIN	⇒ UNITIALIZED
8:		UABRQ[1]	⇒ UNITIALIZED
9:		PABRQ[1],I-PABIN[80]	⇒ UNITIALIZED
11:		PABRQ[1],I-PABIN[81]	⇒ UNITIALIZED

A.3 File regime management protocol machine

A.3.1 States — file regime management

In the FPM:

INITIALIZED	FTAM regime started
SELECT-PD	Select pending, wait for select response PDU
I-SELECT-PD	Select pending, wait for F-SELECT response primitive from the internal file service user
SELECTED	Selected
DESELECT-PD	Deselect pending, wait for deselect response PDU
I-DESELECT-PD	Deselect pending, wait for F-DESELECT response primitive from the internal file service user
CREAT-PD	Create pending, wait for create response PDU
I-CREATE-PD	Create pending, wait for F-CREATE response primitive from the internal file service user
DELETE-PD	delete pending, wait for delete response PDU
I-DELETE-PD	Delete pending, wait for F-DELETE response primitive from the internal file service user
READ-ATT-PD	Read attribute pending, wait for read attribute response PDU
I-READ-ATT-PD	Read attribute pending, wait for F-READ-ATTRIB response primitive from the internal file service user
CHG-ATT-PD	Change attribute pending, wait for change attribute response PDU.
I-CHG-ATT-PD	Change attribute pending, wait for F-CHANGE-ATTRIB response primitive from the internal file service user
OPEN-PD	Open pending, wait for open response PDU
I-OPEN-PD	Open pending, wait for F-OPEN response primitive from the internal file service user
P-ALTIN-PD	Presentation alter context pending, wait for P-ALTER-CONTEXT indication primitive.
P-ALTCF-PD	Presentation alter context pending, wait for P-ALTER-CONTEXT confirm primitive.
CLOSE-PD	Close pending, wait for close response PDU
I-CLOSE PD	Close pending, wait for F-CLOSE response primitive from the internal file service user
DXFRIDLE	Data transfer idle
LOCATE-PD	Locate pending, wait for locate response PDU
I-LOCATE-PD	Locate pending, wait for F-LOCATE response primitive from the internal file service user
ERASE-PD	Erase pending, wait for erase response PDU
I-ERASE-PD	Erase pending, wait for F-ERASE response primitive from the internal file service user
GROUPING	Building PDU group, wait for required primitives
GROUP-PD	Group pending, wait for response PDU group
I-GROUP-PD	Group pending, wait for F-BEGIN-GROUP response primitive from the internal file service user

In the FERPM:

RECOVER-PD	Recover pending, wait for recover response PDU
I-RECOVER-PD	Recover pending, wait for F-RECOVER response primitive from the internal file service user
P-ALTIN-REC-PD	Presentation alter context pending, wait for P-ALTER-CONTEXT indication primitive during recovery.
P-ALTCF-REC-PD	Presentation alter context pending, wait for P-ALTER-CONTEXT confirm primitive during recovery.
DXFRIDLE-REC	Data transfer idle during recovery

A.3.2 Incoming events — file regime management

A.3.2.1 Incoming events — PDUs

CATRQ	Change-attrib request PDU	U6
CATRP	Change-attrib response PDU	U6
CLORQ	Close request PDU	U2, U3
CLORP	Close response PDU	U2, U3
CRERQ	Create request PDU	U5
CRERP	Create response PDU	U5
DELRQ	Delete request PDU	U5
DELRP	Delete request PDU	U5
DESRQ	Deselect request PDU	U1
DESRP	Deselect response PDU	U1
ERARQ	Erase request PDU	U4
ERARP	Erase response PDU	U4
LOCRQ	Locate request PDU	U4
LOCRP	Locate response PDU	U4
OPNRQ	Open request PDU	U2, U3
OPNRP	Open response PDU	U2, U3
RATRQ	Read-attrib request PDU	U5
RATRP	Read-attrib response PDU	U5
RECRQ	Recover request PDU	U9
RECRP	Recover response PDU	U9
SELRQ	Select request PDU	U1
SELRP	Select response PDU	U1
GRPRQ	A sequence of request PDUs (PDU-Group) preceded by an F-BEGIN-GROUP request PDU and followed by a F-END-GROUP request PDU.	U7
GRPRP	A sequence of response PDUs (PDU-Group) preceded by an F-BEGIN-GROUP response PDU and followed by a F-END-GROUP response PDU.	U7

A.3.2.2 Incoming events from the internal file service user

I-CATRQ	F-CHANGE-ATTRIB request primitive
I-CATRP	F-CHANGE-ATTRIB response primitive
I-CLORQ	F-CLOSE request primitive
I-CLORP	F-CLOSE response primitive
I-CRERQ	F-CREATE request primitive
I-CRERP	F-CREATE response primitive
I-DELRQ	F-DELETE request primitive
I-DELRP	F-DELETE response primitive
I-DESRQ	F-DESELECT request primitive
I-DESRP	F-DESELECT response primitive
I-ERARQ	F-ERASE request primitive
I-ERARP	F-ERASE response primitive
I-LOCRQ	F-LOCATE request primitive

I-LOCRP F-LOCATE response primitive
I-OPNRQ F-OPEN request primitive
I-OPNRP F-OPEN response primitive
I-RATRQ F-READ-ATTRIB request primitive
I-RATRP F-READ-ATTRIB response primitive
I-RECRQ F-RECOVER request primitive
I-RECRP F-RECOVER response primitive
I-SELRQ F-SELECT request primitive
I-SELRP F-SELECT response primitive
I-BGPRQ F-BEGIN-GROUP request primitive
I-BGPRP F-BEGIN-GROUP response primitive
I-EGPRQ I-END-GROUP request primitive
I-EGPRP I-END-GROUP response primitive

A.3.2.3 Incoming events from the presentation service provider

P-ALTIN P-ALTER-CONTEXT indication primitive
P-ALTCF P-ALTER-CONTEXT confirm primitive

A.3.3 Outgoing events — file regime management

A.3.3.1 Outgoing events — PDUs

CATRQ Change-attrib request PDU
CATRP Change-attrib response PDU
CLORQ Close request PDU
CLORP Close response PDU
CRERQ Create request PDU
CRERP Create response PDU
DELRQ Delete request PDU
DELRP Delete response PDU
DESRQ Deselect request PDU
DESRP Deselect response PDU
ERARQ Erase request PDU
ERARP Erase response PDU
LOCRQ Locate request PDU
LOCRP Locate response PDU
OPNRQ Open request PDU
OPNRP Open response PDU
PABRQ P-Abort request PDU
RATRQ Read-attrib request PDU
RATRP Read-attrib response PDU
RECRQ Recover request PDU
RECRP Recover response PDU
SELRQ Select request PDU

SELRP Select response PDU

A.3.3.2 Outgoing events to the internal file service user

I-CATIN F-CHANGE-ATTRIB indication primitive

I-CATCF F-CHANGE-ATTRIB confirm primitive

I-CLOIN F-CLOSE indication primitive

I-CLOCF F-CLOSE confirm primitive

I-CREIN F-CREATE indication primitive

I-CRECF F-CREATE confirm primitive

I-DELIN F-DELETE indication primitive

I-DELCF F-DELETE confirm primitive

I-DESIN F-DESELECT indication primitive

I-DESCF F-DESELECT confirm primitive

I-ERAIN F-ERASE indication primitive

I-ERACF F-ERASE confirm primitive

I-LOCIN F-LOCATE indication primitive

I-LOCCF F-LOCATE confirm primitive

I-OPNIN F-OPEN indication primitive

I-OPNCF F-OPEN confirm primitive

I-PABIN F-P-ABORT indication primitive

I-RATIN F-READ-ATTRIB indication primitive

I-RATCF F-READ-ATTRIB confirm primitive

I-RECIN F-RECOVER indication primitive

I-RECCF F-RECOVER confirm primitive

I-SELIN F-SELECT indication primitive

I-SELCF F-SELECT confirm primitive

A.3.3.3 Outgoing events to the presentation service provider

P-ALTRQ P-ALTER-CONTEXT request primitive

P-ALTRP P-ALTER-CONTEXT response primitive

A.3.3.4 Outgoing events to the local system

L-ERRCTX Local signal indicating P-ALTER-CONTEXT error

A.3.4 Specific actions — file regime management

[1] Send the PDU constructed as user data and map parameters on the appropriate ACSE form.

[2] Add a PDU to the current PSDU and terminate the current PSDU.

[8] Includes a state result parameter indicating failure.

[9] Set the remove contexts parameter of the F-OPEN or the F-RECOVER request PDU.

[10] Determine, on the basis of the abstract syntax derived from the contents type supplied by the external file service user, the set of presentation contexts necessary to support the file contents. All contexts identified in the remove context parameter of the OPNRQ or RECRQ PDUs shall be deleted unless required in the new open regime; optionally, the responder may elect to delete any other contexts in the defined context set which are not required. Inform the user if contexts need to be defined but the functioal unit is unavailable

[11] Set the presentation-action parameter of the OPNRP or RECRP PDU if a P-ALTER-CONTEXT exchange is needed.

[15] Preserve the PDU or PDUs for further processing.

[28] Set the bulk data transfer number to that specified in the F-RECOVER request primitive or PDU.

[31] Set the bulk data transfer number to zero.

[32] Erase the expected response list. Set the threshold indicator to the value given by the primitive parameter. Add an F-BEGIN-GROUP request PDU to the current PSDU.

[33] Add a request PDU corresponding to the primitive function to the current PSDU, and add the corresponding element to the expected response list.

[34] Add an F-END-GROUP request PDU to the current PSDU and terminate the PSDU.

[35] Check that every PDU in the PDU-Group is one of SELRP, CRERP, CLORP, RATRP, CATRP, DESRP, DELRP, or OPNRP; and that the composition and ordering of the PDUs is consistent with the group specified by the expected response list (recognizing that the response group may be truncated because of a detected error).

[36] Check that the number of PDUs in the PDU-Group is consistent with the value of the threshold parameter and that the other parameter values are consistent with negotiation.

[37] Considering each PDU in the PDU-Group, issue the corresponding confirm primitive to the IFS user with parameters derived from the PDU.

[38] Add a response PDU corresponding to the primitive function to the current PSDU.

[39] Add an F-END-GROUP response PDU to the current PSDU and terminate the PSDU.

[40] Check that the composition and ordering of the PDU-Group is consistent with one of the concatenated sequences "A", "C", or "D", as defined in Part 3, Annex E.

[41] Check that the composition and ordering of the PDU-Group is consistent with the concatenated sequence "E" as defined in Part 3, Annex E.

[42] Check that the composition and ordering of the PDU-Group is consistent with the concatenated sequence "B" as defined in Part 3, Annex E.

[43] Considering in turn each PDU in the PDU-Group, issue the corresponding indication primitive to the IFS user with parameters derived from the PDU.

[45] Set the checkpoint identifier expected to the value negotiated plus one.

A.3.5 Predicates — file regime management

P4: The state result parameter on the incoming response PDU or response primitive indicates successful execution of operation.

P6: The P-ALTER-CONTEXT negotiation fails.

P7: A group of PDUs is preserved.

P9: The presentation context management functional unit is available and there are presentation contexts to be deleted or defined.

P10: The presentation-action parameter in the OPNRP PDU or in the RECRP PDU is TRUE, in which case the presentation context management functional unit should be available.

P17: The PDU-Group contains a SELRP or CRERP PDU with a state result parameter indicating failure, or a DESRP or DELRP PDU.

P18: Checking the PDU-Group reveals a protocol error.

P19: The PDU-Group contains an OPNRP PDU with a state result parameter indicating success.

P43: The recovery procedure is in progress.

A.3.6 Initiating entity state table — file regime management

STATE / EVENT	INITIALIZED	SELECT-PD	SELECTED	DESELECT-PD	CREATE-PD	DELETE-PD	READ-ATT-PD	CHG-ATT-PD	OPEN-PD	P-ALTIN-PD	DXFRIDLE	DXFRIDLE-REC	CLOSE-PD	RECOVER-PD	P-ALTIN-REC-PD	LOCATE-PD	ERASE-PD	GROUPING	GROUP-PD
I-SELRQ	1																	28	
SELRP		2																	
I-DESRQ			3															28	
DESRP				4															
I-CRERQ	5																	28	
CRERP					6														
I-DELRQ			7															28	
DELRP						8													
I-RATRQ			9															28	
RATRP							10												
I-CATRQ			11															28	
CATRP								12											
I-OPNRQ			13															22	
OPNRP									14										
P-ALTIN										15					21				
I-CLORQ											17	17						28	
CLORP													18						
I-RECRQ	19																		
RECRP														20					
I-LOCRQ											23	23							
LOCRP																24			
I-ERARQ											25	25							
ERARP																	26		
I-BGPRQ	27		27								27	27							
I-EGPRQ																		29	
GRPRP																			30

A.3.7 Initiating entity state table (Part 2) — detailed entries

1: SELRQ[2] ⇒ SELECT-PD

2: P4: I-SELCF ⇒ SELECTED
~P4: I-SELCF[8] ⇒ INITIALIZED

3: DESRQ[2] ⇒ DESELECT-PD

4: I-DESCF ⇒ INITIALIZED

5: CRERQ[2] ⇒ CREATE-PD

6: P4: I-CRECF ⇒ SELECTED
~P4: I-CRECF[8] ⇒ INITIALIZED

7: DELRQ[2] ⇒ DELETE-PD

8:		I-DELCF	⇒ INITIALIZED
9:		RATRQ[2]	⇒ READ-ATT-PD
10:		I-RATCF	⇒ SELECTED
11:		CATRQ[2]	⇒ CHG-ATT-PD
12:		I-CATCF	⇒ SELECTED
13:	P9:	[9], OPNRQ[2],[31]	⇒ OPEN-PD
14:	~P4:	I-OPNCF[8]	⇒ SELECTED
	P4 & ~P10:	I-OPNCF	⇒ DXFRIDLE
	P4 & P10:	[15]	⇒ P-ALTIN-PD
15:	P6:	L-ERRCTX, P-ALTRP,	
	P7:	[37]	⇒ DXFRIDLE
	~P7:	I-OPNCF	⇒ DXFRIDLE
17:		CLORQ[2]	⇒ CLOSE-PD
18:		I-CLOCF	⇒ SELECTED
19:	P9:	[9], RECRQ[2],[28]	⇒ RECOVER-PD
20:	~P4:	I-RECCF[8]	⇒ INITIALIZED
	P4 & ~P10:	[45],I-RECCF	⇒ DXFRIDLE-REC
	P4 & P10:	[15]	⇒ P-ALTIN-REC-PD
21:	P6:	L-ERRCTX, P-ALTRP, [45],I-RECCF	⇒ DXFRIDLE-REC
22:	P9:	[9], [31],[33]	⇒ *same state*
23:		LOCRQ[2]	LOCATE-PD
24:	~P43:	I-LOCCF	⇒ DXFRIDLE
	P43:	I-LOCCF	⇒ DXFRIDLE-REC
25:		ERARQ[2]	⇒ ERASE-PD
26:	~P43:	IERACF	⇒ DXFRIDLE
	P43:	IERACF	⇒ DXFRIDLE-REC
27:		[32]	⇒ GROUPING
28:		[33]	⇒ *same state*
29:		[34]	⇒ GROUP-PD

30:		[35],[36],	
	P18:	I-PABIN, PABRQ[1]	⇒UNINITIALIZED
	P17 & ~P18:	[37]	⇒ INITIALIZED
	~P17 & ~P18 & P19 & ~P10:	[37]	⇒ DXFRIDLE
	~P17 & ~P18 & P19 & P10:	[15]	⇒ P-ALTIN-PD
	~P17 & ~P18 & ~P19:	[37]	⇒ SELECTED

A.3.8 Responding entity state table — file regime management

STATE / EVENT	INITIALIZED	I-SELECT-PD	SELECTED	I-DESELECT-PD	I-CREATE-PD	I-DELETE-PD	I-READ-ATT-PD	I-CHG-ATT-PD	I-OPEN-PD	P-ALTCF-PD	DXFRIDLE	DXFRIDLE-REC	I-CLOSE-PD	I-RECOVER-PD	P-ALTCF-REC-PD	I-LOCATE-PD	I-ERASE-PD	I-GROUP-PD	GROUPING
SELRQ	1																		
I-SELRP		2																	32
DESRQ			3																
I-DESRP				4															32
CRERQ	5																		
I-CRERP					6														32
DELRQ			7																
I-DELRP						8													32
RATRQ			9																
I-RATRP							10												32
CATRQ			11																
ICATRP								12											32
OPNRQ			13																
I-OPNRP									14										22
P-ALTCF										15					21				
CLORQ											17	17							
I-CLORP													18						32
RECRQ	19																		
I-RECRP														20					
LOCRQ											24	24							
I-LOCRP																25			
ERARQ											26	26							
I-ERARP																	27		
I-BGPRP																		31	
I-EGPRP																			33
GRPRQ	28		29								30	30							

A.3.9 Responding entity state table (Part 2) — detail entries

1: I-SELIN ⇒ I-SELECT-PD

2: P4: SELRP[2] ⇒ SELECTED
~P4: SELRP[8][2] ⇒ INITIALIZED

3: I-DESIN ⇒ I-DESELECT-PD

4: DESRP[2] ⇒ INITIALIZED

5: I-CREIN ⇒ I-CREATE-PD

6: P4: CRERP[2] ⇒ SELECTED
~P4: CRERP[8][2] ⇒ INITIALIZED

7: I-DELIN ⇒ I-DELETE-PD

8:		DELRP[2]	⇒ INITIALIZED
9:		I-RATIN	⇒ I-READ-ATT-PD
10:		RATRP[2]	⇒ SELECTED
11:		I-CATIN	⇒ I-CHG-ATT-PD
12:		CATRP[2]	⇒ SELECTED
13:		I-OPNIN,[31]	⇒ I-OPEN-PD
14:	~P4:	OPNRP[8][2]	⇒ SELECTED
	P4:	[10]	
	P4 & ~P9:	OPNRP[2]	⇒ DXFRIDLE
	P4 & P9:	[11],OPNRP[2],P-ALTRQ	⇒ P-ALTCF-PD
15:	P6:	L-ERRCTX,	⇒ DXFRIDLE
17:		I-CLOIN	⇒ I-CLOSE-PD
18:		CLORP[2]	⇒ SELECTED
19:		I-RECIN,[28]	⇒ I-RECOVER-PD
20:	~P4:	RECRP[8][2]	⇒ INITIALIZED
	P4:	[10],[45],	
	P4 & ~ P9:	RECRP[2]	⇒ DXFRIDLE-REC
	P4 & P9:	[11],RECRP[2],P-ALTRQ	⇒ P-ALTCF-REC-PD
21:	P6:	L-ERRCTX,	⇒ DXFRIDLE-REC
22:		[38],[31]	⇒ *same state*
24:		I-LOCIN	⇒ I-LOCATE-PD
25:	~P43:	LOCRP[2]	⇒ DXFRIDLE
	P43:	LOCRP[2]	⇒ DXFRIDLE-REC
26:		I-ERAIN	⇒ I-ERASE-PD
27:	~P43:	ERARP[2]	⇒ DXFRIDLE
	P43:	ERARP[2]	⇒ DXFRIDLE-REC
28:		[40],	
	P18:	I-PABIN,PABRQ[1]	⇒ UNINITIALIZED
	~P18:	[43]	⇒ I-GROUP-PD
29:		[41],	
	P18:	I-PABIN,PABRQ[1]	⇒ UNINITIALIZED
	~P18:	[43]	⇒ I-GROUP-PD
30:		[42],	
	P18:	I-PABIN,PABRQ[1]	⇒ UNINITIALIZED
	~P18:	[43]	⇒ I-GROUP-PD
31:		[38]	⇒ GROUPING
32:		[38]	⇒ *same state*

```
33:                                [39],
     P17:                                          ⇒ INITIALIZED
     ~P17 & P19:                   [10],
     ~P17 & P19 & ~P9:                             ⇒ DXFRIDLE
     ~P17 & P19 & P9               P-ALTRQ         ⇒ P-ALTCF-PD
     ~P17 & ~P19:                                  ⇒ SELECTED
```

NOTE: L-ERRCTX provides information to the responder's environment.

A.4 Bulk data transfer protocol machine

A.4.1 States — bulk data transfer

DXFRIDLE	Data transfer idle
READ	Read data transfer
I-READ-ENDING	Read transfer end, wait for F-TRANSFER-END request primitive from the internal file service user
READ-ENDING	Read transfer ending, wait for transfer end request PDU
I-R-XFR-ENDING	Wait for F-TRANSFER-END response primitive after READ from the internal file service user
R-XFER-ENDING	Wait Wait for transfer-end response PDU after READ
WRITE	Write data transfer
I-WRITE-ENDING	Write transfer-end, wait for F-TRANSFER-END request primitive from the internal file service user
WRITE-ENDING	Write transfer-end, wait for transfer end request PDU
I-W-XFR-ENDING	Wait for F-TRANSFER-END response primitive after WRITE from the internal file service user
W-XFER-ENDING	Wait for transfer-end response PDU after WRITE
CANCEL-PD	Cancel pending, wait for cancel response PDU
I-CANCEL-PD	Cancel pending, wait for F-CANCEL response primitive from the internal file service user
RRESTART-PD	Read restart pending, wait for restart response PDU in read operation
I-RRESTART-PD	Read restart pending, wait for F-RESTART response primitive in read operation from the internal file service user
WRESTART-PD	Write restart pending, wait for restart response PDU in write operation
I-WRESTART-PD	Write restart pending, wait for F-RESTART response primitive in write operation from the internal file service user
P-TOKEN-PD	Wait for sync-minor token
DXFRIDLE-REC	Data transfer idle during recovery
REA-SYMIN-PD	Wait for first P-SYNC-MINOR indication primitive after READ
RES-SYMIN-PD	Wait for first P-SYNC-MINOR indication primitive, restart requested
CAN-SYMIN-PD	Wait for first P-SYNC-MINOR indication primitive, cancel requested
WRT-SYMIN-PD	Wait for first P-SYNC-MINOR indication primitive after WRITE
REA-SYMCF-PD	Wait for first P-SYNC-MINOR confirm primitive after READ
RES-SYMCF-PD	Wait for first P-SYNC-MINOR confirm primitive, restart requested
CAN-SYMCF-PD	Wait for first P-SYNC-MINOR confirm primitive, cancel requested
WRT-SYMCF-PD	Wait for first P-SYNC-MINOR confirm primitive after WRITE
RESTART-CAN-PD	Restart cancel pending, wait for cancel or restart response PDU

A.4.2 Incoming events — bulk data transfer

A.4.2.1 Incoming events — PDUs

CANRP	Cancel response PDU (in user data of P-RESYNC(abandon) confirm if resync functional unit has been negotiated).	U2, U3
CANRQ	Cancel request PDU (in user data of P-RESYNC(abandon) indication if resync functional unit has been negotiated).	U2, U3
DAERQ	Data end request PDU.	U2, U3
TRERP	Transfer end response PDU.	U2, U3

TRERQ	Transfer end request PDU.	U2, U3
RESRQ	Restart request PDU, in user data of P-RESYNC (restart) indication.	U10
RESRP	Restart response PDU, in user data of P-RESYNC (restart) confirm.	U10
REARQ	Read request PDU.	U2
WRTRQ	Write request PDU.	U3
DATIN	data value in user context (not syntactically classed as a PDU).	U2, U3

A.4.2.2 Incoming events from the internal file service user

I-CANRP	F-CANCEL response primitive.
I-CANRQ	F-CANCEL request primitive.
I-CHKRQ	F-CHECK request primitive.
I-CHKRP	F-CHECK response primitive
I-DATRQ	F-DATA request primitive.
I-DAERQ	F-DATA-END request primitive.
I-REARQ	F-READ request primitive.
I-RESRQ	F-RESTART request primitive.
I-RESRP	F-RESTART response primitive
I-TRERQ	F-TRANSFER-END request primitive.
I-TRERP	F-TRANSFER-END response primitive
I-WRTRQ	F-WRITE request primitive.

A.4.2.3 Incoming events from the presentation service provider

P-SYMIN	P-SYNC-MINOR indication primitive.
P-SYMCF	P-SYNC-MINOR confirm primitive.
P-TOKIN	P-TOKEN-GIVE indication with minor-sync. token.

A.4.3 Outgoing events — bulk data transfer

A.4.3.1 Outgoing events — PDUs

CANRP	Cancel response PDU (in user data of P-RESYNC(abandon) response if resync functional unit has been negotiated)
CANRQ	Cancel request PDU (in user data of P-RESYNC(abandon) request if resync functional unit has been negotiated)
DAERQ	Data end request PDU
TRERP	Transfer end response PDU
TRERQ	Transfer end request PDU
RESRQ	Restart request PDU, in user data of P-RESYNC(restart) request
RESRP	Restart response PDU, in user data of P-RESYNC(restart) response
REARQ	Read request PDU
WRTRQ	Write request PDU

A.4.3.2 Outgoing events to the internal file service user

I-CANCF	F-CANCEL confirm primitive
I-CANIN	F-CANCEL indication primitive
I-CHKIN	F-CHECK indication primitive

I-CHKCF	F-CHECK confirm primitive
I-DATIN	F-DATA indication primitive
I-DAEIN	F-DATA-END indication primitive
I-REAIN	F-READ indication primitive
I-RESIN	F-RESTART indication primitive
I-RESCF	F-RESTART confirm primitive
I-TREIN	F-TRANSFER-END indication primitive
I-TRECF	F-TRANSFER-END confirm primitive
I-WRTIN	F-WRITE indication primitive

A.4.3.3 Outgoing events to the presentation service provider

P-SYMRQ	P-SYNC-MINOR request primitive
P-SYMRP	P-SYNC-MINOR response primitive
P-DATRQ	P-DATA request primitive
P-TOKRQ	P-TOKEN-GIVE request primitive with minor-synch token

A.4.3.4 Outgoing events to the local system

L-ERRABT	Local signal indicating an error leading to abort

A.4.4 Specific actions — bulk data transfer

[2] Add a PDU to the current PSDU and terminate the current PSDU.

[15] Preserve the PDU for further processing

[16] Add a PDU to the current PSDU and optionally terminate the current PSDU, according to local decision.

[17] Use for the sync point serial number, the checkpoint received plus the offset.

[18] Add the data given on the F-DATA request to the current PSDU. Optionally (depending upon local system considerations) terminate the PSDU.

[19] Use for the checkpoint, the sync point serial number received minus the offset.

[21] Unset discard indicator.

[22] Set discard indicator and set the outstanding checkpoint counter to zero.

[23] Discard any user data not yet delivered and set outstanding checkpoint counter to zero.

[24] Add 1 to the NSPN.

[25] Terminate the current PSDU.

[26] If Presentation resynchronize functional unit is available, send PDU as user data on a P-RESYNC(abandon) request or response primitive; otherwise add PDU to the current PSDU and terminate the current PSDU.

[27] Increment the checkpoint identifier expected.

[29] Increment the outstanding checkpoint counter.

[30] Decrement the outstanding checkpoint counter according to the checkpoint number confirmed (see 15.3.2).

[44] Increment the bulk data transfer number.

[45] Set the checkpoint identifier expected to the value negotiated plus one.

[46] PDU with the checkpoint identifier is sent as user data on a P-RESYNC(restart) response primitive with sync point serial number equal to those received on the P-RESYNC indication.

[47] Preserve the primitive parameters for subsequent precessing. In some states, it happens that when F-CANCEL primitive is preserved, there is already an F-RESTART primitive preserved: in this case, the F-RESTART primitive shall be discarded.

[48] Set the checkpoint identifier expected to 1.

[49] Set the synchronization offset to the value of the NSPN minus the checkpoint identifier expected. ((In a bulk data transfer that does not involve recovery, the checkpoint identifier is zero, at this point in the protocol)

[50] PDU is sent as user data on a P-RESYNCH (restart) request, with a synchronization point serial number equal to the sum of the checkpoint identifier, on the F-RESTART primitive, and the synchronization offset plus 1.

[51] The checkpoint identifier shall be equal to the value received on the PDU.

[52] Set the NSPN equal to the synch point serial number negotiated with the presentation service provider.

[53] Store the synchronization point serial number provided by the presentation service provider as NSPN.

A.4.5 Predicates — bulk data transfer

P8: The context is not within the defined context set.

P13: The transfer service class has been negotiated and the bulk data transfer number is greater than 1.

P14: The synchronization point exceeds 999 998, exceeding the session service limitation.

P15: Discard indicator is set.

P20: The resync functional unit has been negotiated.

P21: The sync-minor functional unit has been negotiated.

P22: The entity possesses the sync-minor token.

P27: The outstanding checkpoint counter exceeds the agreed maximum.

P41: The expected checkpoint identifier equals the sync point serial number received minus the offset.

A.4.6 Initiating state table — bulk data transfer

STATE / EVENT	DXFRIDLE	DXFRIDLE-REC	REA-SYMIN-PD	RES-SYMIN-PD	CAN-SYMIN-PD	READ	I-READ-ENDING	R-XFER-ENDING	P-TOKEN-PD	WRT-SYMCF-PD	RES-SYMCF-PD	CAN-SYMCF-PD	WRITE	I-WRITE-ENDING	W-XFER-ENDING	CANCEL-PD	I-CANCEL-PD	RRESTART-PD	WRESTART-PD	I-RRESTART-PD	I-WRESTART-PD	RESTART-CAN-PD
I-REARQ	1	35																				
I-WRTRQ	2	36																				
P-TOKIN	42								3							42						
I-DATRQ										4			4									
I-DAERQ										5			5									
DATIN						6										41		41				
DAERQ						8										41		41				
I-TRERQ							9							10								
TRERP								11							3							
I-CANRQ			31	31		12	12			34	34		12					38	38	12	12	
CANRP																13						
CANRQ						14				14			14	14	14	15		14	14	14	14	39
I-CANRP																	16					
I-CHKRQ										17			17									
P-SYMCF										32	22	12	18	37	37	41						
P-SYMIN			29	21	12	19										41						
I-CHKRP						20	20															
I-RESRQ			30			21	21			33			22									
RESRP																		23	24			40
RESRQ						25				26			26	26	26			43	44			
I-RESRP																				27	28	

A.4.7 Initiating entity state table (Part 3) — detailed entries

1:		[44],	
	~P13 & P21:	REARQ[2],P-TOKRQ,[48],[49]	⇒ REA-SYMIN-PD
	~P13 & ~P21:	REARQ[2]	⇒ READ
	P13:	L-ERRABT	⇒ *same state*
2:		[44],	
	P13:	L-ERRABT	⇒ *same state*
	~P13 & ~P21:	WRTRQ[16]	⇒ WRITE
	~P13 & P21:	WRTRQ[2],[24],	
	~P13 & P14 & P21:	L-ERRABT	⇒ *same state*
	~P13 & ~P14 & P21	P-SYMRQ,[48],[49]	⇒ WRT-SYMCF-PD
3:		I-TRECF	⇒ DXFRIDLE
4:	~P8:	P-DATRQ[18]	⇒ *same state*
	P8:	L-ERRABT	⇒ *same state*
5:		DAERQ[16]	⇒ I-WRITE-ENDING

6:	P15:		⇒ *same state*
	~P15:	I-DATIN	⇒ *same state*
8:	P15:		⇒ *same state*
	~P15:	I-DAEIN	⇒ I-READ-ENDING
9:		TRERQ[2]	⇒ R-XFER-ENDING
10:		TRERQ[2]	⇒ W-XFER-ENDING
11:	P21:	[15]	⇒ P-TOKEN-PD
	~P21:	I-TRECF	⇒ DXFRIDLE
12:		[22],[23],CANRQ[26]	=CANCEL-PD
13:	P20:	[53], [21],I-CANCF	⇒ DXFRIDLE
14:	P20:	[53], [22],[23], I-CANIN	⇒ I-CANCEL-PD
15:	P20:	CANRP[26],[53], [21],I-CANCF	⇒ DXFRIDLE
16:	P20:	[53], CANRP[26],[21]	⇒ DXFRIDLE
17:		[25],[27],[24],	
	~P14:	P-SYMRQ	⇒ *same state*
	P14:	L-ERRABT	⇒ *same state*
18:		I-CHKCF[19]	⇒ *same state*
19:		[29],	
	~P27 & P41:	I-CHKIN,[24],[27]	⇒ *same state*
	P27 I ~P41:	L-ERRABT	⇒ *same state*
20:		[30],P-SYMRP[17]	⇒ *same state*
21:		[22],RESRQ[50]	⇒ RRESTART-PD
22:		[22],RESRQ[50]	⇒ WRESTART-PD
23:		[52],[45],[49],[21],I-RESCF	⇒ READ
24:		[52],[45],[49],[21],I-RESCF	⇒ WRITE
25:		[23],I-RESIN	⇒ I-RRESTART-PD
26:		I-RESIN	⇒ I-WRESTART-PD
27:		[52],[45],[49],RESRP[46]	⇒ READ
28:		[52],[45],[49],RESRP[46]	⇒ WRITE
29:		[24],[49],P-SYMRP	⇒ READ
30:		[47],[22]	⇒ RES-SYMIN-PD
31:		[47],[22]	⇒ CAN-SYMIN-PD
32:		[49]	⇒ WRITE

33		[47],[22]	⇒ RES-SYMCF-PD
34:		[47],[22]	⇒ CAN-SYMCF-PD
35:		REARQ[2],P-TOKRQ,[49]	⇒ REA-SYMIN-PD
36:		WRTRQ[2],[24],	
	P14:	L-ERRABT	⇒ *same state*
	~P14:	P-SYMRQ,[49]	⇒ WRT-SYMCF-PD
37:		I-CHKCF[19]	⇒ *same state*
38:		[47]	⇒ RESTART-CAN-PD
39:	P20:	[52],	
		[21],I-CANCF,CANRP[26]	⇒ DXFRIDLE
40:		CANRQ[26]	⇒ CANCEL-PD
41:			⇒ *same state*
42:			⇒ *same state*
43:		[52],[45],[49],[21],I-RESCF,RESRP[46]	⇒ READ
44:		[52],[45],[49],[21],I-RESCF,RESRP[46]	⇒ WRITE

NOTE - The entries 38, 39, 40 are due to the Session service behaviour in the resynchronize management, in collision cases.

A.4.8 Responding entity state table — bulk data transfer

STATE / EVENT	DXFRIDLE	DXFRIDLE-REC	P-TOKEN-PD	REA-SYMCF-PD	RES-SYMCF-PD	CAN-SYMCF-PD	READ	READ-ENDING	I-R-XFR-ENDING	WRT-SYMIN-PD	RES-SYMIN-PD	CAN-SYMIN-PD	WRITE	WRITE-ENDING	!-W-XFR-ENDING	CANCEL-PD	I-CANCEL-PD	RREST ART-PD	WRESTART-PD	I-RRESTART-PD	I-WRESTART-PD	RESTART-CAN-PD
REARQ	1	36																				
WRTRQ	2	37																				
P-TOKIN			3																			
I-DATRQ				4			4															
I-DAERQ				5			5															
DATIN													6			42			42			
DAERQ													8			42			42			
TRERQ								9						10		42			42			
I-TRERP									11						43							
I-CANRQ				30	30		12			33	33		12	12	12			39	39	12	12	
CANRP																13						
CANRQ				14	14		14	14					14			44		14	14	14	14	40
I-CANRP																	15					
I-CHKRQ				16			16															
P-SYMCF				28	20	12	18	38								42						
P-SYMIN										31	34	35	17			42						
I-CHKRP													19	19								
I-RESRQ				29			20			32			21	21	21							
RESRP																		22	23			41
RESRQ				24			24	24	24				25					45	46			
I-RESRP																				26	27	

A.4.9 Responding entity state table (Part 3) — detailed entries

1:		[44],	
	~P13 & P21:	[15],[48],[49]	⇒ P-TOKEN-PD
	~P13 & ~P21:	I-REAIN	⇒ READ
	P13:	L-ERRABT	⇒ *same state*
2:		[44],	
	~P13 & P21:	I-WRTIN,[48],[49]	⇒ WRT-SYMIN-PD
	~P13 & ~P21:	I-WRTIN	⇒ WRITE
	P13:	L-ERRABT	⇒ *same state*
3:		I-REAIN,[24],	
	~P14:	P-SYMRQ	⇒ READ-SYMCF-PD
	P14:	L-ERRABT	⇒ *same state*
4:	~P8:	P-DATRQ[18]	⇒ *same state*
	P8:	L-ERRABT	⇒ *same state*
5:		DAERQ[2]	⇒ READ-ENDING

6:	P15:		⇒ *same state*
	~P15:	I-DATIN	⇒ *same state*
8:	P15:		⇒ *same state*
	~P15:	I-DAEIN	⇒ WRITE-ENDING
9:	P15:		⇒ *same state*
	~P15:	I-TREIN	⇒ I-R-XFR-ENDING
10:	P15:		⇒ *same state*
	~P15:	I-TREIN	⇒ I-W-XFR-ENDING
11:	P21:	TRERP[2],P-TOKRQ	⇒ DXFRIDLE
	~P21:	TRERP[2]	⇒ DXFRIDLE
12:		[22],[23],CANRQ[26]	⇒ CANCEL-PD
13:	P21 & P22 & ~P20:	P-TOKRQ,	
	P20:	[53],	
		[21],I-CANCF	⇒ DXFRIDLE
14:	P20:	[53],	
		[22],[23],I-CANIN	⇒ I-CANCEL-PD
15:	P21 & P22 & ~P20:	P-TOKRQ,	
	P20:	[53],	
		CANRP[26],[21]	⇒ DXFRIDLE
16:		[25],[27],[24]	
	~P14:	P-SYMRQ	⇒ *same state*
	P14:	L-ERRABT	⇒ *same state*
17:		[29],	
	~P27 & P41:	I-CHKIN,[24],[27]	⇒ *same state*
	P27 I ~P41:	L-ERRABT	⇒ *same state*
18:		I-CHKCF[19]	⇒ *same state*
19:		[30],P-SYMRP[17]	⇒ *same state*
20:		[22],RESRQ[50]	⇒ RRESTART-PD
21:		[22],RESRQ[50]	⇒ WRESTART-PD
22:		[52],[45],[49],[21],I-RESCF	⇒ READ
23:		[52],[45],[49],[21],I-RESCF	⇒ WRITE
24:		I-RESIN	⇒ I-RRESTART-PD
25:		[23],I-RESIN	⇒ I-WRESTART-PD
26:		[52],[45],[49],RESRP[46]	⇒ READ
27:		[52],[45],[49],RESRP[46]	⇒ WRITE
28:		[49]	⇒ READ
29:		[22],[47]	⇒ RES-SYMCF-PD
30:		[22],[47]	⇒ CAN-SYMCF-PD

31:		[24],[49],P-SYMRP	⇒ WRITE
32:		[22],[47]	⇒ RES-SYMIN-PD
33:		[22],[47]	⇒ CAN-SYMIN-PD
34:		[24],P-SYMRP,[22],RESRQ[50]	⇒ WRESTART-PD
35:		[24],P-SYMRP,[22],CANRQ[26]	⇒ CANCEL-PD
36:		[15],[49]	⇒ P-TOKEN-PD
37:		I-WRTIN,[49]	⇒ WRT-SYMIN-PD
38:		I-CHKCF[19]	⇒ *same state*
39:		[22],[47]	⇒ RESTART-CAN-PD
40:	P21 & P22 & ~P20: P20:	P-TOKRQ, [53], [21],I-CANCF,CANRP[26]	⇒ DXFRIDLE
41:		CANRQ[26]	⇒ CANCEL-PD
42:			⇒ *same state*
43:		TRERP[2]	⇒ DXFRIDLE
44:	P21 & P22&~P20: P20:	P-TOKRQ, [53],CANRP[26], [21],I-CANCF	⇒ DXFRIDLE
45:		[52],[45],[49],[21],I-RESCF[51],RESRP[46]	⇒ READ
46:		[52],[45],[49],[21],I-RESCF,RESRP[46]	⇒ WRITE

NOTE - The entries 14, 39, 40, 41, 45, and 46 are due to the Session service behaviour in the resynchronize management, in collision cases.

A.5 File error recovery protocol machine (FERPM)

Note - The description of the file error recovery protocol machine given here omits the description of grouping, which does not materially affect the recovery behaviour. The transitions for the grouped cases can be derived from those in the basic protocol machine.

A.5.1 States — file error recovery

INIT-PD	Initialize pending, wait for an I-INICF event as an F-INITIALIZE confirm primitive from the IFS.
PASSIVE	The basic file protocol is currently in operation but no transfer of file contents is in progress. It is used when the FERPM becomes inactive in normal error free activity, or when it cannot provide its services any more after issuing an L-ERRABT signal.
XFER-IDLE	Data transfer idle.
XFER	Normal transfer of file contents has been established.
RESTART-PD	Restart pending, wait for an I-RESCF event as an F-RESTART confirm primitive from the IFS.
RESTART	A restart of a data transfer is in progress. A checkpoint identifier has been negotiated, and data following that checkpoint, but prior to the error, is being retransmitted.
CANCEL-PD	Cancel pending, wait for an I-CANCF event as an F-CANCEL confirm primitive from the IFS.
CLOSE-EX	Close expected, wait for an I-CLOIN event as an F-CLOSE indication primitive from the IFS.
DESELECT-EX	Deselect expected, wait for an I-DESIN event as an F-DESELECT indication primitive from the IFS.
RECOVER-PD	Recover pending, wait for an I-RECCF event as an F-RECOVER confirm primitive from the IFS.
SEL-PD	SELECT pending, wait for an I-SELCF event as an F-SELECT confirm primitive from the IFS.
OPN-PD	OPEN pending, wait for an I-OPNCF event as an F-OPEN confirm primitive form the IFS.
SEL-EX	SELECT expected, wait for an I-SELIN event as an F-SELECT indication primitive from the IFS.
OPN-EX	OPEN expected, wait for an I-OPNIN event as an F-OPEN indication primitive form the IFS.
XFER-EX	Data transfer expected, wait for an I-REAIN/I-WRTIN as an F-READ/F-WRITE indication primitive from the IFS.
INIT-EX	Initiation expected, wait for an I-ININ event as an F-INITIALIZE indication primitive from the IFS.
CLOSE-PD	Close pending, wait for an I-CLOCF event as an F-CLOSE confirm primitive from the IFS.
DESELECT-PD	Deselect pending, wait for an I-DESCF event as an F-DESELECT confirm primitive from the IFS.

A.5.2 Incoming events — file error recovery

A.5.2.1 Incoming events from the external file service user

F-OPNRQ	F-OPEN request primitive
F-CLORQ	F-CLOSE request primitive
F-REARQ	F-READ request primitive
F-WRTRQ	F-WRITE request primitive
F-DATRQ	F-DATA request primitive
F-DAERQ	F-DATA-END request primitive
F-TRERQ	F-TRANSFER-END request primitive
F-ANYRQ	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DESELECT, F-LOCATE, F-ERASE, F-BEGIN-GROUP, F-END-GROUP, F-TERMINATE and F-U-ABORT request primitives
F-OPNRP	F-OPEN response primitive
F-CLORP	F-CLOSE response primitive

F-TRERP	F-TRASNSFER-END response primitive
F-ANYRP	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DESELECT, F-LOCATE, F-ERASE, F-BEGIN-GROUP, F-TERMINATE, and F-END-GROUP response primitives
F-CANRQ	F-CANCEL request primitive
F-CANRP	F-CANCEL response primitive

A.5.2.2 Incoming events from the internal file service

I-INICF	F-INITIALIZE confirm primitive
I-OPNCF	F-OPEN confirm primitive
I-CLOCF	F-CLOSE confirm primitive
I-DATIN	F-DATA indication primitive
I-DAEIN	F-DATA-END indication primitive
I-CHKIN	F-CHECK indication primitive
I-CHKCF	F-CHECK confirm primitive
I-TRECF	F-TRANSFER-END confirm primitive
I-ANYCF	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DELESELECT, F-LOCATE, F-ERASE, F-BEGIN-GROUP, F-TERMINATE, and F-END-GROUP confirm primitive
I-SELCF	F-SELECT confirm primitive
I-DESCF	F-DESELECT confirm primitive
I-INIIN	F-INITIALIZE indication primitive
I-SELIN	F-SELECT indication primitive
I-DESIN	F-DESELECT indication primitive
I-OPNIN	F-OPEN indication primitive
I-CLOIN	F-CLOSE indication primitive
I-TREIN	F-TRANSFER-END indication primitive
I-CANIN	F-CANCEL indication primitive
I-CANCF	F-CANCEL confirm primitive
I-PABIN	F-P-ABORT indication primitive
I-RECCF	F-RECOVER confirm primitive
I-RESCF	F-RESTART confirm primitive
I-RECIN	F-RECOVER indication primitive
I-RESIN	F-RESTART indication primitive
I-ANYIN	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DESELECT, F-LOCATE, F-ERASE, F-BEGIN-GROUP, F-END-GROUP, F-TERMINATE, F-U-ABORT and F-P-ABORT indication primitives
I-REAIN	F-READ indication primitive
I-WRTIN	F-WRITE indication primitive

A.5.2.3 Incoming events from the Local System Environment

L-ERROR1	Class I error (as defined in 18.1)
L-ERROR2	Class II error (as defined in 18.1)
L-ERROR3	Class III error (as defined in 18.1)
L-GIVEUP	Signal to give up recovery process

L-DATRQ	Reissued F-DATA request primitive
L-CHKRQ	Reissued F-CHECK request primitive
L-DAERQ	Reissued F-DATA-END request primitive
L-EORIN	Indicates that all checkpoint identifiers and "data end" markers in the docket have been used, and all data to be resent have been sent.
L-HOLD	Signal to the FERPM to hold any primitive from the external user for later processing
L-UNHOLD	Signal to FERPM to process any previous held primitives

A.5.3 Outgoing events — file error recovery

A.5.3.1 Outgoing events to the external file service user

F-OPNCF	F-OPEN confirm primitive
F-ANYCF	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DESELECT, F-LOCATE, F-ERASE, F-TERMINATE, F-BEGIN-GROUP and F-END-GROUP confirm primitives
F-CLOCF	F-CLOSE confirm primitive
F-DATIN	F-DATA indication primitive
F-DAEIN	F-DATA-END indication primitive
F-TRECF	F-TRANSFER-END confirm primitive
F-OPNIN	F-OPEN indication primitive
F-WRTIN	F-WRITE indication primitive
F-CLOIN	F-CLOSE indication primitive
F-REAIN	F-READ indication primitive
F-TREIN	F-TREANSFER-END indication primitive
F-ANYIN	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DESELECT, F-LOCATE, F-ERASE, F-TERMINATE, F-BEGIN-GROUP, F-END-GROUP, F-U-ABORT and F-P-ABORT indication primitives
F-PABIN	F-P-ABORT indication primitive
F-CANIN	F-CANCEL indication primitive
F-CANCF	F-CANCEL confirm primitive

A.5.3.2 Outgoing events to the internal file service

I-SELRQ	F-SELECT request primitive
I-OPNRQ	F-OPEN request primitive
I-CLORQ	F-CLOSE request primitive
I-DATRQ	F-DATA request primitive
I-DAERQ	F-DATA-END request primitive
I-CHKRQ	F-CHECK request primitive
I-TRERQ	F-TRANSFER-END request primitive
I-REARQ	F-READ request primitive
I-WRTRQ	F-WRITE request primitive
I-ANYRQ	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DESELECT, F-LOCATE, F-ERASE, F-TERMINATE, F-BEGIN-GROUP, F-END-GROUP and F-U-ABORT request primitives
I-INIRP	F-INITIALIZE response primitive
I-OPNRP	F-OPEN response primitive

I-SELRP	F-SELECT response primitive
I-CLORP	F-CLOSE response primitive
I-TRERP	F-TRANSFER-END response primitive
I-ANYRP	F-INITIALIZE, F-READ-ATTRIBUTE, F-CHANGE-ATTRIBUTE, F-SELECT, F-CREATE, F-DESELECT, F-LOCATE, F-ERASE, F-TERMINATE, F-BEGIN-GROUP and F-END-GROUP response primitives
I-CHKRP	F-CHECK response primitive
I-RESRQ	F-RESTART request primitive
I-RESRP	F-RESTART response primitive
I-CANRQ	F-CANCEL request primitive
I-CANRP	F-CANCEL response primitive
I-DESRQ	F-DESELECT request primitive
I-RECRQ	F-RECOVER request primitive
I-INIRQ	F-INITIALIZE request primitive
I-RECRP	F-RECOVER response primitive
I-DESRP	F-DESELECT response primitive

A.5.3.3 Outgoing events to the local system environment

L-ERROR2	Signal indicating class II error
L-ERROR3	Signal indicating class III error
L-RESEND	Resend data request to the local system
L-STPSND	Stop resending data and checkpoint requests to the local system
L-SUSPND	Suspend issuing of F-DATRQ, F-DAERQ by the local system
L-RESUME	Resume issuing of F-DATRQ, F-DAERQ by the local system
L-ERRABT	Signal FPM to issue an F-P-ABORT request PDU, with permanent error value.
L-PABORT	Signal FPM to issue a F-P-ABORT request PDU, and a F-P-ABORT indication primitive to the FERPM, both with transient error value.
L-HOLD	Hold primitives from external user
L-UNHOLD	Process any held primitives

A.5.4 Specific actions — file error recovery

[54] Mark the checkpoint identifiers to be reissued.

[55] Delete the docket.

[56] Set the activity state indicator to “finished”.

[57] Set the activity state indicator to “in-progress”.

[58] Set the activity type indicator to “read”.

[59] Set the activity type indicator to “write”.

[60] Add the checkpoint identifier to the list in the docket. Increment the count of outstanding checkpoints by one.

[61] Delete from the docket all checkpoint identifiers smaller than the parameter in the primitive received or issued. Decrement the count of outstanding checkpoints by the number of the deleted identifiers.

[63] Set the activity state indicator to "starting".

[64] Set the activity state indicator to “data transfer finished”.

[66] Use the last checkpoint identifier in the docket as the parameter.

[67] Increment the checkpoint identifier count.

[68] Set the checkpoint identifier count to zero.

[69] Record the bulk data transfer number in the docket (the number is maintained by the FPM).

[70] Record which data values have been already delivered to the user.

[71] Use as the parameter the checkpoint identifier available in the docket that is both

a) after the checkpoint identifier negotiated, and
b) not yet reissued during this restart of the BDT.

[72] Use as parameter the checkpoint identifier.

[73] Use as the parameter the oldest (first) checkpoint identifier in the list in the docket.

[74] Use as the parameter the checkpoint identifier of the primitive received.

[75] Use as the diagnostics parameter "activity identifier unknown".

[76] Record which data values have been sent.

[77] Create a docket and record in it the activity identifier, the information needed to issue or check an I-INIRQ (including the locations of the initiator and responder), the recovery mode, the access context, the presentation context, a null checkpoint list and set the activity state indicator to "starting".

[78] The issuer of the I-RESRQ or I-RECRQ primitive identifies a checkpoint identifier which is

a) for the sender, the last point acknowledged,
b) for the receiver, the last point received and secured.

[79] The issuer of the I-RESRP primitive identifies a checkpoint identifier which is

c) for the sender, equal to the value provided by the issuer of the request, and
d) for the receiver, the last point received and secured.

[200] Wait for $2^{\text{Recommended retry time}}$ seconds.

[201] Include a state result indicating failure.

[202] Use the data value specified by the L-DATRQ signal, representing previous F-DATA request primitives, as the parameter.

[203] Use as the parameter the checkpoint identifier negotiated.

[204] Store "data end" marker in the docket.

[206] Delete "data end" marker in the docket.

[207] Include an action result indicating transient error.

[209] Recreate select and open regimes.

[210] Include a action result indicating failure on next response with diagnostic of damage to open/select regime.

[211] Include a diagnostic of damage to open/select regime.

[212] Use as the parameter the bulk data transfer number recorded in the docket.

[213] Store "transfer end" marker (reflecting information on the PDU) in the docket.

[214] Delete "transfer end" marker from docket.

[215] Clear activity type indicator.

[216] Clear the activity state indicator.

A.5.5 Predicates — file error recovery

P23: The incoming response or confirm primitive has a state result indicating success.

P24: There are checkpoints that must be confirmed.

P26: An F-DATA indication primitive corresponding to the incoming I-DATIN has already been issued to the user.

P28: The data value available is after the negotiated checkpoint.

P29: The activity state indicator is set to "in-progress" and the activity type indicator to "read".

P30: The activity state indicator is set to "in-progress" and the activity type indicator to "write".

P31: The activity type indicator is set to "read".

P32: The activity type indicator is set to "write".

P33: The activity state indicator is set to "starting".

P34: The activity state indicator is set to "finished".

P37: A checkpoint identifier is to be inserted in the data stream.

P39: The entity has the docket for the activity identifier recovered, the current initiator matches the location, and the activity can be resumed.

P40: The entity is sender of data.

P99: The transfer service class has been negotiated.

P100: The recommended retry time field is present on the diagnostic parameter.

P101: The specified recovery is possible and is required.

P102: The specified association is possible.

P103: The incoming request or indication primitive has an action result indicating transient error.

P104: The "transfer end" marker is stored in the docket.

P105: The activity state indicator is set to "data transfer finished".

P106: The "data end" marker is stored in the docket.

A.5.6 Initiating entity state table — FERPM — (normal procedure)

STATE / EVENT	PASSIVE	XFER-IDLE	XFER
F-OPNRQ	1		
I-OPNCF	2		
F-ANYRQ	3	3	
I-ANYCF	4	4	
F-CLORQ		5	
I-CLOCF		6	
F-REARQ		7	
F-WRTRQ		8	
F-DATRQ			9
I-DATIN			10
I-CHKCF			11
I-CHKIN			12
F-DAERQ			13
I-DAEIN			14
F-TRERQ			15
I-TRECF			16
F-CANRQ			17
I-CANCF			18
I-CANIN			19
F-CANRP			20

A.5.7 Initiating entity state table — FERPM — detailed entries (normal procedure)

1:		[77],I-OPNRQ	⇒ *same state*
2:	P23:	F-OPNCF	⇒ XFER-IDLE
	~P23:	[55],F-OPNCF[201]	⇒ *same state*
3:		I-ANYRQ	⇒ *same state*
4:		F-ANYCF	⇒ *same state*
5:		[56],I-CLORQ	⇒ *same state*
6:		[55],F-CLOCF	⇒ PASSIVE
7:		[57],[58],[68],I-REARQ,[69]	⇒ XFER
8:		[57],[59],[68],I-WRTRQ,[69]	⇒ XFER
9:	P37:	[67],[60],I-CHKRQ[72], [76],I-DATRQ	⇒ *same state*
10:		[70],F-DATIN	⇒ *same state*
11:		[61]	⇒ *same state*

12:	P24:	[60], I-CHKRP,[61],	⇒ *same state*
13:		[204],I-DAERQ	⇒ *same state*
14:	P24:	I-CHKRP[66],[61], [204],F-DAEIN	⇒ *same state*
15:	P29:	[64], [213],I-TRERQ	⇒ *same state*
16:	~P99: P99:	[63], [64], [215],[206],[214],F-TRECF	⇒ XFER-IDLE
17:		I-CANRQ	⇒ *same state*
18:		[215],[216],[206],[214],F-CANCF	⇒ XFER-IDLE
19:		F-CANIN	⇒ *same state*
20:		[215],[216],[206],[214],I-CANRP	⇒ XFER-IDLE

A.5.8 Responding entity state table — FERPM — (normal procedure)

STATE / EVENT	PASSIVE	XFER-IDLE	XFER
I-OPNIN	1		
F-OPNRP	2		
F-ANYRP	3	3	
I-ANYIN	4	4	
I-CLOIN		5	
F-CLORP		6	
I-REAIN		7	
I-WRTIN		8	
F-DATRQ			9
I-DATIN			10
I-CHKCF			11
I-CHKIN			12
F-DAERQ			13
I-DAEIN			14
I-TREIN			15
F-TRERP			16
F-CANRQ			17
I-CANCF			18
I-CANIN			19
F-CANRP			20

A.5.9 Responding entity state table — FERPM — detailed entries (normal procedure)

1:		[77],F-OPNIN	⇒ *same state*
2:	P23:	I-OPNRP	⇒ XFER-IDLE
	~P23:	[55],I-OPNRP[201]	⇒ *same state*
3:		I-ANYRP	⇒ *same state*
4:		F-ANYIN	⇒ *same state*
5:	~P103:	[56],F-CLOIN	⇒ *same state*
6:		[55],I-CLORP	⇒ PASSIVE
7:		[57],[58],[68],F-REAIN,[69]	⇒ XFER
8:		[57],[59],[68],F-WRTIN,[69]	⇒ XFER
9:	P37:	[67],[60],I-CHKRQ[72], [76],I-DATRQ	⇒ *same state*
10:		[70],F-DATIN	⇒ *same state*
11:		[61]	⇒ *same state*

12:	P24:	[60], I-CHKRP,[61],	⇒ *same state*
13:		[204],I-DAERQ	⇒ *same state*
14:	P24:	I-CHKRP[66],[61], [204],F-DAEIN	⇒ *same state*
15:	P29:	[64], [213],F-TREIN	⇒ *same state*
16:	~P99: P99:	[63], [64], [215],[214],[206],I-TRERP	⇒ XFER-IDLE
17:		I-CANRQ	⇒ *same state*
18:		[215],[216],[206],[214],F-CANCF	⇒ XFER-IDLE
19:		F-CANIN	⇒ *same state*
20:		[215],[216],[206],[214],I-CANRP	⇒ XFER-IDLE

Note - The condition "P103" in entry 6 is handled in A.5.17 (in entry 16).

A.5.10 Initiating entity state table — FERPM — (class I errors)

STATE / EVENT	XFER	RESTART-PD	RESTART
L-ERROR1	1		1
I-RESCF		2	
I-RESIN	3		
I-DATIN			4
I-CHKCF			6
I-DAEIN			7
L-DATRQ			9
L-CHKRQ			10
L-DAERQ			11
L-EORIN			12
I-CANIN		13	13
I-CANCF		14	14
F-CANRQ		15	15
F-CANRP		16	16

A.5.11 Initiating entity state table — FERPM — detailed entries (class I errors)

1:	P101 & P40:	L-SUSPND,I-RESRQ[78]	⇒ RESTART-PD
	P101 & ~P40:	I-RESRQ[78]	⇒ RESTART-PD
	~P101:	L-ERROR2	⇒ XFER
2:	~P40:	[61]	⇒ RESTART
	P40:	[54],[61],L-RESEND[74]	⇒ RESTART
3:	~P40:	I-RESRP[79]	⇒ RESTART
	P40:	L-SUSPND,[54],[61],I-RESRP[79],L-RESEND[203]	⇒ RESTART
4:	P26:		⇒ *same state*
	~P26:	F-DATIN	⇒ XFER
6:		[61]	⇒ *same state*
7:	P24:	I-CHKRP[66],[61],	
	~P106:	F-DAEIN	⇒ XFER
	P106 & ~P104:	L-UNHOLD	⇒ XFER
	P106 & P104:	L-UNHOLD, I-TRERQ	⇒ XFER
9:	P28:	I-DATRQ[202]	⇒ *same state*
	~P28:		⇒ *same state*
10:		I-CHKRQ[71]	⇒ *same state*
11:		I-DAERQ, L-UNHOLD	⇒ *same state*
12:	~P104:	L-RESUME	⇒ XFER
	P104:	I-TRERQ, L-RESUME	⇒ XFER

13:	~P103&~P40:	F-CANIN	⇒ *same state*
	~P103&P40:	L-STPSND,FCANIN	⇒ *same state*
14:	~P103:	[215],[216],[206],[214],F-CANCF	⇒ XFER-IDLE
15:	~P40:	I-CANRQ	⇒ *same state*
	P40:	L-STPSND,I-CANRQ	⇒ *same state*
16:		[215],[216],[206],[214],I-CANRP	⇒ XFER-IDLE

NOTE: The conditin P103 in entries 13 and 14 is handled in entries 2 and 3 of A.5.14.

A.5.12 Responding entity state table — FERPM — (class I errors)

STATE / EVENT	XFER	RESTART-PD	RESTART
L-ERROR1	1		1
I-RESCF		2	
I-RESIN	3		
I-DATIN			4
I-CHKCF			6
I-DAEIN			7
L-DATRQ			9
L-CHKRQ			10
L-DAERQ			11
L-EORIN			12
I-TREIN			13
I-CANIN		14	14
I-CANCF		15	15
F-CANRQ		16	16
F-CANRP		17	17

A.5.13 Responding entity state table — FERPM — detailed entries (class I errors)

1:	P101 & P40:	L-SUSPND,I-RESRQ[78]	⇒ RESTART-PD
	P101 & ~P40:	I-RESRQ[78]	⇒ RESTART-PD
	~P101:	L-ERROR2	⇒ XFER
2:	~P40:	[61]	⇒ RESTART
	P40:	[54],[61],L-RESEND[74]	⇒ RESTART
3:	~P40:	I-RESRP[79]	⇒ RESTART
	P40:	L-SUSPND,[54],[61],I-RESRP[79],L-RESEND[203]	⇒ RESTART
4:	P26:		⇒ *same state*
	~P26:	F-DATIN	⇒ XFER
6:		[61]	⇒ *same state*
7:	P24:	I-CHKRP[66],[61],	
	~P106:	F-DAEIN	⇒ XFER
	P106 & P104:		⇒ *same state*
	P106 & ~P104:		⇒ XFER
9:	P28:	I-DATRQ[202]	⇒ *same state*
	~P28:		⇒ *same state*
10:		I-CHKRQ[71]	⇒ *same state*
11:		I-DAERQ[206]	⇒ *same state*

12:	~P104:	L-RESUME	⇒ XFER
	P104:	L-RESUME	⇒ *same state*
13:		L-UNHOLD	⇒ XFER
14:	~P103&~P40:	F-CANIN	⇒ *same state*
	~P103&P40:	L-STPSND,FCANIN	⇒ *same state*
15:	~P103:	[215],[216],[206],[214],F-CANCF	⇒ XFER-IDLE
16:	~P40:	I-CANRQ	⇒ *same state*
	P40:	L-STPSND,I-CANRQ	⇒ *same state*
17:		[215],[216],[206],[214],I-CANRP	⇒ XFER-IDLE

NOTE: The conditin P103 in entries 13 and 14 is handled in entries 2 and 3 of A.5.16.

A.5.14 Initiating entity state table — FERPM — detailed entries — (class II and III errors)

STATE / EVENT	XFER	RESTART-PD	RESTART	CANCEL-PD	CLOSE-PD	DESELECT-PD	RECOVER-PD	INIT-PD	PASSIVE	SEL-PD	OPN-PD	XFER-IDLE
L-ERROR2	1	1	1									11
I-CANIN	2	2	2									
I-CANCF				3								
I-CLOCF					4							
I-DESCF						5						
I-RECCF							6					
L-ERROR3	7	7	7	7	7	7	7		7	7	7	7
I-PABIN	12	12	12	12	12	12	12		12	12	12	12
I-SELCF										9		
I-OPNCF											10	
I-INICF								8				

A.5.15 Initiating entity state table — FERPM — detailed entries (class II and III errors)

1:	~P101 & P104:	L-ERROR3	⇒ *same state*
	~P101:	[55],L-ERRABT	⇒ PASSIVE
	P101 & ~P40 & ~P106:	I-CANRQ[207]	⇒ CANCEL-PD
	P101 & P40:	L-SUSPND,I-CANRQ[207]	⇒ CANCEL-PD
	P101 & ~P40 & P106:	I-CANRQ[207],L-HOLD	⇒ CANCEL-PD
2:	P103 & ~P40:	I-CANRP,I-CLORQ	⇒ CLOSE-PD
	P103 & P40:	L-SUSPND,I-CANRP,I-CLORQ	⇒ CLOSE-PD
3:		I-CLORQ	⇒ CLOSE-PD
4:		I-DESRQ	⇒ DESELECT-PD
5:		I-RECRQ[212][78]	⇒ RECOVER-PD
6:	P23 & (P29 I P31) & ~(P30 I P32):	[209],I-REARQ	⇒ RESTART
	P23 & (P30 I P32) & ~(P29 I P31):	[209],I-WRTRQ,L-RESEND[74]	⇒ RESTART
	~P23 & ~P33 & P34:	[55],F-CLOCF[211],L-ERRABT	⇒ PASSIVE
	~P23 & P33 & ~P34:	L-HOLD,I-SELRQ	⇒ SEL-PD
	~P23 & P101 & ~(P34 I P33) & (P29 I P30 I P31 I P32):	I-RECRQ[212][78]	⇒ *same state*
	~P23 & ~P101 & ~(P34 I P33 I P105) & (P29 I P30 I P31 I P32):	[55],L-ERRABT	⇒ PASSIVE
	~P23 & ~P33 & ~P34 & P105 & P99:	[55],F-TRECF[211],L-ERRABT	⇒ PASSIVE
	~P23 & ~P33 & ~P34 & P105 & ~P99:	F-TRECF,I-SELRQ,[215],[206],[214]	⇒ SEL-PD
7:	P106:	L-HOLD,	
	P40:	L-SUSPND,	
	P100 & P101:	L-PABORT,[200],I-INIRQ	⇒ INIT-PD
	~P100 & P101:	L-PABORT,I-ININQ	⇒ INIT-PD
	~P101:	[55],L-ERRABT	⇒ PASSIVE

8:	P23 & ~P31 & P32:	I-RECRQ[73][212]	⇒ RECOVER-PD
	P23 & P31 & ~P32:	I-RECRQ[66][212]	⇒ RECOVER-PD
	~P23 & P102:	[200],I-ININRQ	⇒ *same state*
	~P23 & ~P102:	[55],L-ERRABT	⇒ PASSIVE
9:	P23:	I-OPNRQ	⇒ OPN-PD
	~P23:	[55],L-ERRABT	⇒ PASSIVE
10:	P23:	L-UNHOLD	⇒ XFER-IDLE
	~P23:	[55],L-ERRABT	⇒ PASSIVE
11:	~P101:	[55],L-ERRABT	⇒ PASSIVE
	P101:	L-HOLD,I-CLORQ[211]	⇒ CLOSE-PD
12:	P106:	L-HOLD,	
	P40 & P103 & P100 & P101:	L-SUSPND,[200],I-ININRQ	⇒ INIT-PD
	~P40 & P103 & P100 & P101:	[200],I-ININRQ	⇒ INIT-PD
	P40 & P103 & ~P100 & P101:	L-SUSPND,I-ININRQ	⇒ INIT-PD
	~P40 & P103 & ~P100 & P101:	I-ININRQ	⇒ INIT-PD
	~P103 I ~P101:	[55],F-PABIN	⇒ PASSIVE

NOTES

1 To avoid recovery procedures that never terminate the action in entry 6 by the condition P101 or ~P101 effectively allowing the local system to determine the number of times a recovery from any one error will be attempted.

2 The condition P101 in entries 12 and 7 includes the test when FQOS is zero but the FERPM is not null.

3 The condition ~P103 in entry 2 implies that this event is not relevant to the FERPM and that normal actions take over.

4 The predicates which model the activity state indicator are mutually exclusive, so that combinations of them cannot occur. These combinations are not included in the state table entries.

A.5.16 Responding entity state table — FERPM — (class II and III errors)

STATE / EVENT	XFER	RESTART-PD	RESTART	CANCEL-PD	CLOSE-EX	DESELECT-EX	PASSIVE	XFER-EX	INIT-EX	SEL-EX	OPN-EX	XFER-IDLE
L-ERROR2	1	1	1				14					
I-CANIN	2	2	2									
I-CANCF				3								
I-CLOIN					4							16
I-DESIN						5						
I-RECIN							6					
L-ERROR3	7	7	7	7	7	7	7	7		7	7	7
I-PABIN	17	17	17	17	17	17	17	17		17	17	17
L-GIVEUP							12					
I-INIIN									8			
I-REAIN								13				
I-WRTIN								9				
I-SELIN										10		
I-OPNIN											11	

A.5.17 Responding entity state table — FERPM — detailed entries (class II and III errors)

1:	~P101 & P104:	L-ERROR3	⇒ *same state*
	~P101:	[55],L-ERRABT	⇒ PASSIVE
	P101 & P40:	L-SUSPND,I-CANRQ[207]	⇒ CANCEL-PD
	P101 & ~P40 & ~P104:	I-CANRQ[207]	⇒ CANCEL-PD
	P101 & ~P40 & P104:	I-CANRQ[207],L-HOLD	⇒ CANCEL-PD
2:	P103 & P40:	L-SUSPND,I-CANRP	⇒ CLOSE-EX
	P103 & ~P40:	I-CANRP	⇒ CLOSE-EX
3:			⇒ CLOSE-EX
4:		I-CLORP	⇒ DESELECT-EX
5:		I-DESRP	⇒ PASSIVE
6:	P101 & P31 & ~P32 & ~P33 & P39:	[209],I-RECRP[74]	⇒ XFER-EX
	P101 & ~P31 & P32 & ~P33 & P39:	[209],I-RECRP[66]	⇒ XFER-EX
	P101 & ~P31 & ~P32 & P33 & P39:	I-RECRP[201]	⇒ SEL-EX
	P101 & ~P31 & ~P32 & ~P33 & P39:	I-RECRP[201]	⇒ *same state*
	P101 & ~P39:	I-RECRP[75][201]	⇒ *same state*
	~P101:	I-RECRP[201]	⇒ *same state*
7:	P104:	L-HOLD,	
	P101 & ~P40:	L-PABORT	⇒ INIT-EX
	P101 & P40:	L-PABORT,L-SUSPND	⇒ INIT-EX
	~P101:	[55],L-ERRABT	⇒ PASSIVE

8:	P102:	I-INIRP	⇒ PASSIVE
	~P102:	I-INIRP[201]	⇒ PASSIVE
9:	P30:		⇒ RESTART
	~P30:	[55],L-ERRABT	⇒ PASSIVE
10:		L-SELRP	⇒ OPN-EX
11:		L-UNHOLD,I-OPNRP	⇒ XFER-IDLE
12:		[55],L-ERRABT	⇒ *same state*
13:	P29:	L-RESEND[203]	⇒ RESTART
	~P29:	[55],L-ERRABT	⇒ PASSIVE
14:	P101:	[210],L-HOLD	⇒ *same state*
	~P101:	[55],L-ERRABT	⇒ *same state*
16:	P103	I-CLORP,L-HOLD	⇒ DESELECT-EX
17:	P104:	L-HOLD,	
	P103 & P101 & P40:	L-SUSPND	⇒ INIT-EX
	P103 & P101 & ~P40:		⇒ INIT-EX
	~P103 | ~P101:	[55],F-PABIN	⇒ PASSIVE

NOTES

1 The condition P101 in entries 7 and 17 includes the test when FQOS is zero but the FERPM is not null.

2 The condition ~P103 in entries 2 and 16 implies that this event is not relevant to the FERPM and that normal actions take over.

3 The predicates which model the activity state indicator are mutually exclusive, so that combinations of them cannot occur. These combinations are not included in the state table entries.

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