CORBA - FTAM/FTP Interworking Specification

Version 1.0
March 2002

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Preface

About the Object Management Group

The Object Management Group, Inc. (OMG) is an international organization supported by over 600 members, including information system vendors, software developers and users. Founded in 1989, the OMG promotes the theory and practice of object-oriented technology in software development. The organization's charter includes the establishment of industry guidelines and object management specifications to provide a common framework for application development. Primary goals are the reusability, portability, and interoperability of object-based software in distributed, heterogeneous environments. Conformance to these specifications will make it possible to develop a heterogeneous applications environment across all major hardware platforms and operating systems.

OMG's objectives are to foster the growth of object technology and influence its direction by establishing the Object Management Architecture (OMA). The OMA provides the conceptual infrastructure upon which all OMG specifications are based.

What is CORBA?

The Common Object Request Broker Architecture (CORBA), is the Object Management Group's answer to the need for interoperability among the rapidly proliferating number of hardware and software products available today. Simply stated, CORBA allows applications to communicate with one another no matter where they are located or who has designed them. CORBA 1.1 was introduced in 1991 by Object Management Group (OMG) and defined the Interface Definition Language (IDL) and the Application Programming Interfaces (API) that enable client/server object interaction within a specific implementation of an Object Request Broker (ORB). CORBA 2.0, adopted in December of 1994, defines true interoperability by specifying how ORBs from different vendors can interoperate.

Associated OMG Documents

The CORBA documentation set includes the following:

- *Object Management Architecture Guide* defines the OMG's technical objectives and terminology and describes the conceptual models upon which OMG standards are based. It defines the umbrella architecture for the OMG standards. It also provides information about the policies and procedures of OMG, such as how standards are proposed, evaluated, and accepted.
- *CORBA: Common Object Request Broker Architecture and Specification* contains the architecture and specifications for the Object Request Broker.
- *CORBA Languages*, a collection of language mapping specifications. See the individual language mapping specifications.
- *CORBAservices: Common Object Services Specification* contains specifications for OMG's Object Services.
- *CORBAfacilities: Common Facilities Specification* includes OMG's Common Facility specifications.
- *CORBA Manufacturing*: Contains specifications that relate to the manufacturing industry. This group of specifications defines standardized object-oriented interfaces between related services and functions.
- *CORBA Med*: Comprised of specifications that relate to the healthcare industry and represents vendors, healthcare providers, payers, and end users.
- *CORBA Finance*: Targets a vitally important vertical market: financial services and accounting. These important application areas are present in virtually all organizations: including all forms of monetary transactions, payroll, billing, and so forth.
- *CORBA Telecoms*: Comprised of specifications that relate to the OMG-compliant interfaces for telecommunication systems.

The OMG collects information for each book in the documentation set by issuing Requests for Information, Requests for Proposals, and Requests for Comment and, with its membership, evaluating the responses. Specifications are adopted as standards only when representatives of the OMG membership accept them as such by vote. (The policies and procedures of the OMG are described in detail in the *Object Management Architecture Guide*.)

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Typographical Conventions

The type styles shown below are used in this document to distinguish programming statements from ordinary English. However, these conventions are not used in tables or section headings where no distinction is necessary.

Helvetica bold - OMG Interface Definition Language (OMG IDL) and syntax elements.

`Courier bold` - Programming language elements.

Helvetica - Exceptions

Terms that appear in *italics* are defined in the glossary. Italic text also represents the name of a document, specification, or other publication.

Acknowledgments

The following companies submitted parts of this specification:

- Ericsson
- Siemens AG
- Broadcom Eireann Research
- Distributed Systems Technology Centre
- Floorboard
- IONA
- Lucent
- PrismTech
- University of California, Irvine

Service Description 1

1.1 File Transfer in Telecoms Systems

Retrieving data from a remote Network Element (NE) and maintaining the software that runs on that node is relatively straightforward but performing the same operations on potentially thousands of Network Elements presents the telecommunication operator with a significant challenge. These tasks are currently performed using either the ISO specified File Transfer, Access and Maintenance (FTAM) protocol or the File Transfer Protocol (FTP). Currently Operations Support Systems (OSS) employs either FTAM or FTP to perform both data retrieval and software maintenance tasks.

This specification describes a single set of IDL interfaces that will allow any OSS to perform its file management operations on underlying Network Elements regardless of the type of file management mechanism the underlying node is using. There are a number of reasons that identify the need for such interfaces:

- OSSs may be implemented in a large number of programming languages and deployed in a platform-independent manner. In addition to using existing OSS systems, telecommunication operators may also employ an alternative, lightweight OSS client that has all of the features of the legacy systems but performs the management of Network Elements through the IDL interfaces.
- The complexity of performing data retrieval and file maintenance operations is hidden from the OSS user by a single set of IDL interfaces. No knowledge of FTP, FTAM, or other file access mechanisms is necessary for them to perform their job.
- The task of extending the set of data retrieval and file maintenance operations is made easier. New management or retrieval operations to meet changing requirements may be exposed to the OSS through a new IDL interface. Existing OSSs may continue to use the original IDL interfaces without interruption.
- The task of migrating a large installed base of OSSs to use a new file management mechanism will be less complex and take considerably less time to perform since the same set of IDL interfaces is being used.

There are a number of system configurations that are possible through the deployment of the interfaces. One such configuration is illustrated in Figure 1-1.

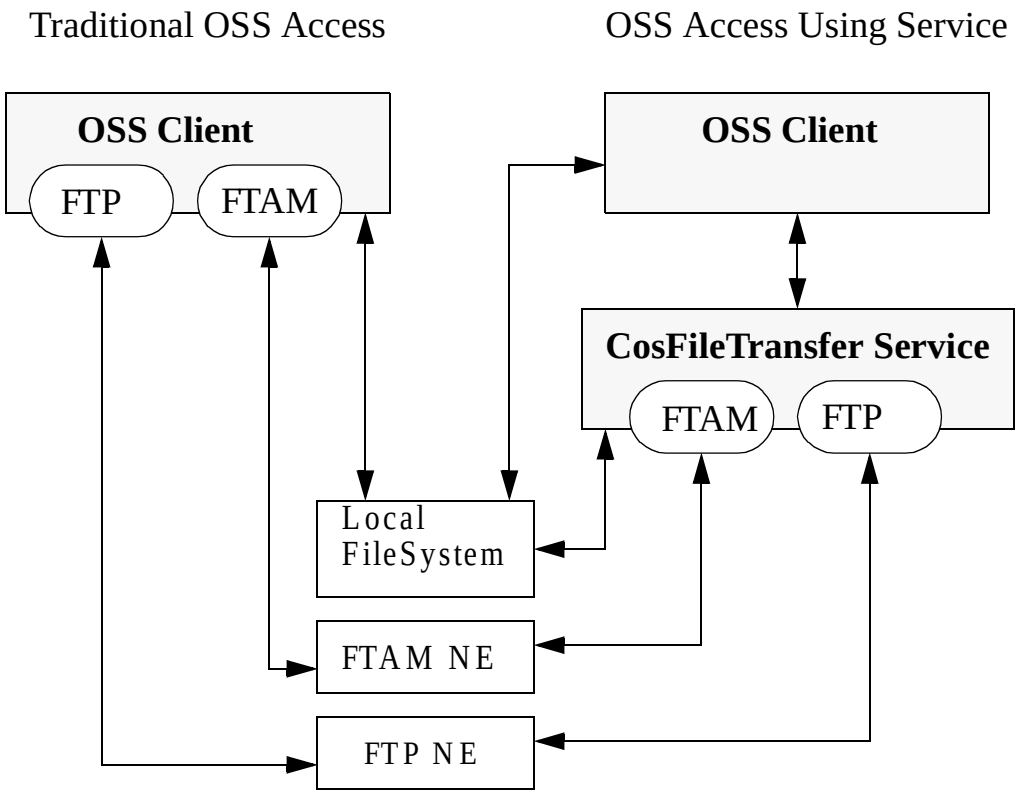

Figure 1-1 High-level system overview

Traditionally different file transfer clients were required for each type of fileserver within the telecoms OSS. By exposing basic file transfer functionality through a set of IDL interfaces it is possible to develop less complex file transfer clients that are independent of the underlying file transfer protocols. The use of CORBA allows remote management of systems over corporate intranets.

1.1.1 File Transfer Capable Network Elements

The primary focus of this specification is defining a file transfer IDL that provides uniform access to FTAM and FTP NEs. However, the scope and utility of the file transfer IDL is not limited to use with only FTAM and FTP. Any NE may support the file transfer IDL for data transfer. Clients often transfer files to a local file system, which itself can be represented by the IDL. Non-file based information can also be transferred. For example, an NE may support access to operational and performance data through “virtual” files and directories, accessible by the file transfer IDL. The NE itself may not actually store this data in physical files and directories.

Service Architecture 2

2.1 Overview

This service defines a set of interfaces that model a simplified virtual file system.

A client obtains access to a file system by logging in and accessing an initial directory. A directory provides access to the file system entries that it contains. A file system entry is a data file or a directory.

A client may perform basic maintenance tasks on file system entries. A client may also log on to multiple file systems to transfer files between them. The types of operations a client may perform include:

- Copy, insert, or append the contents of a file to another file.
- List the entries in a directory.
- Create a new directory.
- Remove an existing directory or file.
- Query a file or directory for properties such as creation time or size.

An implementation may restrict a client's access to any particular file, directory, property, or operation based on the credentials the client used to login to the file system.

2.1.1 File System Servers

The files and directories a client accesses through the service interfaces are virtual proxies for entities internal to the service. The specification places no restrictions on the internal structure or form of these entities.

The service interface is capable of providing virtual file systems for:

- FTP servers

- FTAM responders
- Local file systems
- NEs presenting arbitrary data as virtual files and directories through the service interfaces.

No details specific to FTAM, FTP, or a specific NE are exposed in the IDL. A client is unaware of the underlying service implementation and may transfer files between services through a CORBA interface or another negotiated transfer protocol such as FTP.

2.1.2 Principal Components

The **CosFileTransfer** module defines the following primary interfaces:

- **FileSystem** - The virtual file system the service represents.
- **FileSession** - The login session a client is granted to access the file system.
- **FileSystemEntry** - A base interface providing common operations for files and directories.
- **Directory** - A virtual directory that a client can list the entries in.
- **DirEntryIterator** - An iterator to access a list of file system entry properties.
- **File** - A virtual file that can be copied, inserted, or appended to another file.

The following two interfaces provide more advanced transfer control and direct access to a file's content:

- **TransferEndPoint** - An object that represents one end of a file's transfer connection. It is used for a single transfer.
- **OctetTransferIterator** - An iterator to read and write file contents.

The above two interfaces are used internally by a service implementation to provide the basic file transfer operations.

2.1.3 Files and Directories

Names

FileSystem entries have a simple single component name, **EntryName**, that is unique to their immediate parent **Directory** and a multi-component **EntryPath** that is relative to any ancestor **Directory**.

Basic Maintenance Operations

The basic operations such as **get_path**, **remove**, **exists**, **create_directory**, are described starting in Section 3.1, "CosFileTransfer Module," on page 3-1.

Directory Lists

The following pseudo-code illustrates logging in to a **FileSystem** and listing the names of the entries.

```
...
session = fileSys.login(user, password, lprops, home_dir);

// relative dir path: “sub1/sub2/dir3”
String [] dirPath = {
    “sub1”, “sub2”, “dir3”
}

subDir = home_dir.get_directory(dirPath);

// desired properties: file name and size
String[] dirProps = {
    “name”, “size”
}

entryItor = subDir.list(dirProps);

// Iterate through entries, printing returned properties
offset = 0;
if (entryItor != null){
    do{
        entries = entryItor.next(0,0);
        for(e=0; e<entries.length(); ++e){
            printNameAndSize(entries[e]);
        }
        offset += entries.length();
    }
    while(entries.length()!=0);
}

session.destroy();
```

2.1.4 File Transfer

The service transfers files between file systems. The protocol used for the transfer is negotiated when the transfer is initiated. The supported protocols are:

- CORBA - “IDL:omg.org/CosFileTransfer/OctetTransferIterator:1.0” - mandatory
- FTP - optional
- FTAM - optional
- Additional CORBA interfaces - optional

Clients are coded identically regardless of the transfer protocol used. **OctetTransferIterator** support is mandatory to guarantee that any two service implementations will be able to transfer files if no other common transfer protocol is available. A service may offer additional CORBA transfer interfaces besides this.

Binary File Transfer

All file transfers are binary. This service has no concept of character code-sets and does not make a distinction between text and binary files as defined by FTP and FTAM.

2.1.4.1 High Level File Transfer Operations

Basic file transfer operations for transferring data from one file system to another are available on the **File** interface. The pseudo-code below illustrates logging on to two file systems and performing the high level transfer operations: copy, append, and insert. The full IDL descriptions are in Section 3.1, “CosFileTransfer Module,” on page 3-1.

```
fromSess = fsFrom.login(user1, password1, lprops1, dirFrom);
toSess   = fsTo.login(user2, password2, lprops2, dirTo);

String[] fromName = {
    // filename is: “from_dir_name/from_file_name”
    “from_dir_name”, “from_file_name”
};

String [] toName = {
    // filename is: “to_dir_one/to_dir_two/to_file_name”
    “to_dir_one”, “to_dir_two”, “to_file_name”
};

fromFile = dirFrom.get_file(fromName, true); // must exist
toFile   = dirTo.get_file(toName, false);    // need not

fromFile.copy(toFile);
fromFile.append(toFile);
fromFile.insert(toFile, 1024);

fromSess.destroy();
toSess.destroy();
```

When the client is finished, the file sessions are destroyed to release all server resources. Support for the append and insert operations is optional.

2.1.4.2 File Transfer Implementation

Additional transfer primitives are required for services to implement the high level transfer operations described above. Clients may also use these primitives to directly control more advanced transfer operations.

To implement a file transfer, the **File** interface has a few additional methods. The interface **TransferEndPoint** is defined to represent a file's connection endpoint for the duration of a single file transfer.

A transfer between two **Files** is carried out in the following steps.

1. Negotiate the protocol to be used for the file transfer:
   - Determine a common transfer protocol: FTP, FTAM, or a CORBA interface.
   - Determine which end point of the transfer connection will wait for connection, *the passive end point*, and which end will actively connect, *the active endpoint*.
2. Create the appropriate **TransferEndPoint** objects for each **File**.
3. The passive endpoint is put in a listening state, awaiting connection.
4. The active endpoint makes the connection.
5. The passive endpoint is notified the active connection has been made.
6. The transfer operation is called on the source endpoint.

These steps are described in more detail in the next sections.

Protocol Negotiation

The method **File::get_transfer_protocols** returns a preference ordered list of the transfer protocols supported by the **File**. Some example return lists are:

"IDL:omg.org/CosFileTransfer/OctetTransferIterator:1.0"

"ftp"

This list says that the **File** can be transferred using either the specified corba interface or a FTP data connection in either **active** or **passive** mode. Support for the **CosFileTransfer::OctetTransferIterator** interface is mandatory. In this case it is listed to indicate that it is preferred over FTP.

"ftp;active"

"IDL:CompanyX.com/CryptoTransfer/CompressedIterator:1.0"

"ftam;passive"

This list says that the **File** can be transferred using FTP if the **File** actively makes the data connection. If FTP cannot be used, the specified corba interface is the next preferred transfer protocol. Finally, FTAM may be used with this endpoint taking on the passive role. Since support for the **OctetTransferIterator** interface is mandatory it is not required to be listed.

To transfer from **File** A to **File** B, the **Files** are queried for their supported protocols. This list is examined and a compatible set is chosen. An example being **"ftp;active"** for **File** A and **"ftp;passive"** for **File** B. If a transfer protocol string does not specify active or passive, it supports both. This is always the case for the **OctetTransferIterator** protocol.

Transfer protocol syntax is specified in Sectio n2.2.1, "Protocol Syntax," on page2-8.

TransferEndPoint Creation

The method **File::create_transfer_endpoint** is used to create the necessary **TransferEndPoints**. It takes arguments that specify whether this endpoint is the source or a destination of the transfer, the read/write offset into the **File**, and whether the offset is relative to the beginning or end of the **File**. These parameters can specify endpoints usable as the source or sink of copy, append, and insert operations. See Section 3.1.7, “File Interface,” on page 3-13 for details.

Passive Endpoint Listen

The passive **TransferEndPoint** is put into a wait for connection (listening) state by calling **go_to_listen**. It is then ready to accept a connection from the active **TransferEndPoint**. This method returns a **TransferDetail** describing the passive endpoint.

Active Endpoint Connection

The active **TransferEndPoint** completes the connection circuit when **connect_to_peer** is called. The argument to this method is the **TransferDetail** returned from **go_to_listen**. This method returns a **TransferDetail** string describing the active endpoint protocol specific details. For some protocols, the returned **TransferDetail** may be an empty string.

Passive Endpoint Connect Notify

The last step in the connection establishment is calling **set_peer** on the passive endpoint to notify it that the connection has been made. The argument to this method is the **TransferDetail** returned from the **connect_to_peer** operation. For some protocols, **set_peer** may accept an empty string.

Low Level Transfer Example

The following example illustrates the execution of an append operation, where the negotiated protocol is “FTP.” The sender is **passive** and the receiver is **active**.

```
...
fromFile = dirFrom.get_file(fromName);
toFile   = dirTo.get_file(toName);

fromProtocols = fromFile.get_end_point_protocols();
toProtocols   = toFile.get_end_point_protocols();

// From the protocol lists, find a matching
// protocol set. “ftp” is used for this example,
// the sender will be passive, listening
// for ftp data connection
...
fromProtocol = “ftp;passive”;
toProtocol = “ftp;active”;
```

```
// create endpoints to append the file

fromEP = fromFile.create_endpoint(TransferEndPointRole::SOURCE,
                                  FilePos::BEGIN,
                                  0,
                                  fromProtocol);

toEP = fromFile.create_endpoint(TransferEndPointRole::SINK,
                                  FilePos::END,
                                  0,
                                  toProtocol);

// establish connection
passiveDetail = fromEP.go_to_listen();
activeDetail  = toEP.connect_to_peer(passiveDetail);
fromEP.set_peer(activeDetail);

fromEP.transfer();

fromEP.destroy();
toEP.destroy();
```

This example would follow the same form if a different transfer protocol were used. To change the operation to a **copy**, the **SINK** endpoint would have **FilePos::BEGIN** and offset of zero. Inserts are performed by specifying a **TransferEndPointRole** of **SINK_INSERT** for the destination endpoint. An implementation may restrict the types of **TransferEndPoints** supported.

2.1.4.3 Direct File Access

To allow direct access to the contents of a file from a client that cannot provide another **TransferEndPoint** or **File**, the **OctetTransferIterator** interface can be used to read and write file contents directly. An example of reading the contents of a “text” file for display is shown in the pseudo-code below:

```
...
protocol = “IDL:omg.org/CosFileTransfer/OctetTransferIterator:1.0”
fromEP = fromFile.create_endpoint(TransferEndPointRole::SOURCE,
                                  FilePos::BEGIN,
                                  0,
                                  protocol);

// go_to_listen returns “IOR:....”
// as the TransferDetail for a corba protocol

corbaDetail = fromEP.go_to_listen();
octetItorObj = orb.string_to_object(corbaDetail);
octetItor = OctetTransferIterator.narrow(octetItorObj);

do{
```

```
    octetBuf = octetItor.get_octet_seq(offset, 0);
    printBuffer(octetBuf); // print file as text
    offset = offset + octetBuf.length();
}
while(octetBuf.length()!=0);

fromEP.destroy();
```

2.2 File Transfer Protocols

This section describes the details of the supported file transfer protocols.

2.2.1 Protocol Syntax

The protocol syntax defines protocol names and protocol specific attributes. The syntax is extensible to allow new protocols and attributes to be added. The syntax for the currently supported protocols is:

<ProtocolSpec> ::= <CORBA> | <FTP> | <FTAM> | <NewProtocol>

<CORBA> ::= <OctetTransfer> | <OtherCORBA>
<OctetTransfer> ::=
“IDL:org.omg.CosFileTransfer/OctetTransferIterator:1.0”
<OtherCORBA> ::= <InterfaceID> [<Options>]
<InterfaceID> ::= Valid Repository ID

<FTP> ::= “ftp” [<ActivePassiveOption>]
<FTAM> ::= “ftam” [<ActivePassiveOption>]

<ActivePassiveOption> ::= “;” [“active” | “passive”]
<NewProtocol> ::= <AlphaNumericString> [<Options>]
<Options> ::= “;” <Tag>[“=” <Value>][<Options>]
<Tag> ::= <AlphaNumericString>
<Value> ::=<AlphaNumericString>

2.2.2 Transfer Connection Establishment

Service implementations and clients using transfer primitives are required to use connection establishment semantics that are functionally equivalent to the following:

```
// protocol independent connection establishment
passiveDetail = passiveEP.go_to_listen();
activeDetail  = activeEP.connect_to_peer(passiveDetail);
passiveEP.set_peer(activeDetail);
```

The one exception is if a client is directly accessing a **File** using the **OctetTransferIterator** interface as described previously in Section 2.1.4.3, “Direct File Access,” on page 2-7. In this case only, it is sufficient to call **go_to_listen** and then use the returned **OctetTransferIterator** immediately.

2.2.3 CORBA Transfer Protocol

The following is required for a service implementation to support a CORBA transfer protocol.

File::create_end_point must return a corba aware **TransferEndPoint** when the endpoint protocol argument begins with an interface repository ID.

TransferEndPoint::go_to_listen must return a stringified object reference that can be passed to **TransferEndPoint::go_to_listen** or used directly by a client.

TransferEndPoint::connect_to_peer must return a stringified object reference that can be passed to **TransferEndPoint::set_peer**.

The **OctetTransferIterator** corba protocol does not have a concept of active or passive, so either endpoint can be used as passive or active. This may not be true for other corba transfer interfaces. An implementation supporting **OctetTransferIterator** may implement the high level transfer operations in a manner similar to the one outlined by the example in Section 2.1.4.3, “Direct File Access,” on page 2-7.

There is no requirement for an implementation to make use of the stringified object reference that is passed to **set_peer** for a corba transfer protocol.

An implementation must allow the **set_peer** argument to be an empty string. This represents the case where a client is using an **OctetTransferIterator** directly.

2.2.4 FTP Transfer Protocol

The ftp transfer protocol, refers specifically to a file transfer that takes place as if it were the data connection of an ftp[1] service transfer. A service implementation need not use a true ftp server to implement this transfer protocol.

The following is required for a service implementation to support the ftp transfer protocol.

File::create_end_point must return an ftp aware **TransferEndPoint** when the endpoint protocol argument is an ftp type.

TransferEndPoint::go_to_listen must return a string of the form:

host:port

1.IETF RFC 959 “File Transfer Protocol (FTP)”, J. Postel, J.Reynolds. October 1985

where host is either a DNS style host name or a dotted decimal IP address and port identifies the port number that will accept the ftp data connection.The returned **host:port** string is passed to **TransferEndPoint::go_to_listen**.

TransferEndPoint::connect_to_peer must return a **host:port** string identifying the local end of the ftp data connection that has been established. In some cases this information may not be available, in which case an empty string is returned. The returned string is passed to **TransferEndPoint::set_peer**.

There is no requirement for an implementation to make use of the **host:port** that is passed to **set_peer** for the ftp transfer protocol.

2.2.5 FTAM Transfer Protocol

The following is required for a service implementation to support the FTAM[2] transfer protocol.

File::create_end_point must return an FTAM aware **TransferEndPoint** when the endpoint protocol argument is an FTAM type.

TransferEndPoint::go_to_listen must return a string identifying an FTAM responder.

The returned **responder** string is passed to **TransferEndPoint::go_to_listen**.

TransferEndPoint::connect_to_peer must return a string identifying the FTAM initiator. The returned string is passed to **TransferEndPoint::set_peer**.

2.ISO/IEC 8571-1,8571-2,8571-3,8571-4 Information Processing Systems - Open Systems Interconnection - File Transfer, Access, and Management Parts 1 - 4. 1993

Service Interfaces 3

3.1 CosFileTransfer Module

This chapter describes the **CosFileTransfer** module in detail.

3.1.1 Exceptions

The following IDL shows the exceptions defined for the service:

```
typedef short ErrorCode;
const ErrorCode UNSPECIFIED          = 0;
const ErrorCode UNAVAILABLE          = 1;
const ErrorCode UNSUPPORTED          = 2;
const ErrorCode NO_PERMISSION        = 3;

const ErrorCode ENTRY_EXISTS         = 4;
const ErrorCode ENTRY_PATH_ERROR     = 5;
const ErrorCode ENTRY_IO_ERROR       = 6;
const ErrorCode DIR_NOT_EMPTY        = 7;

const ErrorCode TRANSFER_IO_ERROR    = 8;
const ErrorCode TRANSFER_ABORT       = 9;


    exception FileSystemError {
        ErrorCode error;
        wstring desc;
    };

    // Error transferring between two files

    exception TransferError {
        TransferEndPointRole error_endpoint;
```

```
        ErrorCode error;
        wstring desc;
    };
```

3.1.1.1 ErrorCode

The exceptions defined in the **CosFileTransfer** module contain an **ErrorCode** field which identifies the category of the error. The values are:

- **UNSPECIFIED** - The error category is none of the below.
- **UNAVAILABLE** - The **FileSystem** is temporarily unavailable. This is only raised by the **FileSystem::login** method.
- **UNSUPPORTED** - The operation or the particular parameter values are unsupported by the implementation.
- **NO_PERMISSION** - The user credentials are insufficient or invalid for the requested operation.
- **ENTRY_PATH_ERROR** - A component of the name specified for a **File** or **Directory** is invalid or the entry does not exist.
- **ENTRY_EXISTS** - The operation expected the entry not to already exist.
- **ENTRY_IO_ERROR** - There has been an error opening, reading, writing, or closing a **File** or **Directory**.
- **DIR_NOT_EMPTY** -The implementation does not allow removal of a **Directory** that is not empty.
- **TRANSFER_IO_ERROR** - There has been an error opening, reading, writing, or closing a data transfer connection.
- **TRANSFER_ABORT** - A file transfer operation has been aborted.

Client ErrorCode Handling

In this chapter, each operation description lists the exceptions raised along with specific **ErrorCode** values. A service implementation may use **ErrorCode** values other than those specifically listed. A client must handle these values gracefully, at the very least handling them like **UNSPECIFIED**.

3.1.1.2 FileSystemError

This exception is raised when an operation involving a single **CosFileTransfer** object fails. The fields are:

- **error -** A broad classification of the error.
- **desc** - Optional text detail about the error.

3.1.1.3 TransferError

TransferError is raised by operations that involve copying one **File**'s contents to another. Since there are two **Files** involved, the one that raised the exception must be identified. The fields are:

- **error_endpoint** - Identifies whether the exception originated from the source or sink of the data transfer.
- **error -** A broad classification of the error.
- **desc** - Optional text detail about the error.

3.1.2 FileSystem Interface

The **FileSystem** interface provides access to the virtual file system represented by the service. The IDL is:

```
interface FileSystem {

    FileSession login(in wstring user,
                      in wstring password,
                      in CosPropertyService::Properties login_properties,
                      out Directory initial_dir)
        raises(FileSystemError);

        wstring get_system_id();
};
```

3.1.2.1 login

Before transferring files or performing maintenance operations, a client must provide credentials to login to the **FileSystem** to obtain an initial **Directory** reference. The **FileSystem** validates the user credentials in an implementation specific manner.

Parameters

- **user** - **FileSystem** specific text string identifying the user.
- **password** - **FileSystem** specific text string identifying the user password.
- **login_details** - sequence of **FileSystem** specific properties providing login details. A **FileSystem** implementation may use any property names and values that are appropriate. The following properties with **wstring** values are defined:
  - **user** - Same value as the user parameter. If this property is present, the **user** parameter is ignored.
  - **password** - Same value as the password parameter. If this property is present, the **password** parameter is ignored.
  - **account** - Many systems have the concept of an account in addition to a user.
- **initial_dir** - returns the initial **Directory** for the supplied login details.

Return value

This method returns a **FileSession** (see Section 3.1.3, “FileSession Interface,” on page 3-4) for the supplied login parameters.

Exceptions

FileSystemError - The following **ErrorCode** values are defined:

- **UNAVAILABLE** - The **FileSystem** is unavailable for login. In this case, no attempt has been made to validate the user credentials. A retry by the client may be successful.
- **NO_PERMISSION** - The supplied user credentials were rejected.

3.1.2.2 get_system_id

Returns implementation specific text providing identification of the file system. This text shall be suitable for display to an end user.

Return value

Returns a **wstring** identifying the file system. This string is for informational purposes only and cannot be used to determine object identity. An implementation is not required to make this string globally unique. An empty string is a legal return value.

3.1.3 FileSession Interface

The **FileSession** interface controls the lifecycle of all object references obtained from the server. The IDL is:

```
interface FileSession {
    void destroy();
};
```

3.1.3.1 destroy

The **destroy** operation terminates the session with the service established by the call to **FileSystem::login**. All objects associated with the **FileSession** such as **Directories**, **Files**, etc. are destroyed. After the **destroy** method is invoked, further operations on the **FileSession** or any of its associated objects will raise an **OBJECT_NOT_EXIST**.

The status of any file transfers that are in progress at the time of a call to **destroy** are undefined.

3.1.4 FileSystemEntry Interface

FileSystemEntry is a base interface that defines operations that are common to the **Directory** (Section 3.1.5, “Directory Interface,” on page 3-8) and **File** (Section 3.1.7, “File Interface,” on page 3-13) interfaces.

3.1.4.1 Properties

The interface derives from **CosProperty::PropertySet**. The properties are defined in Table 3-1.

Table 3-1 FileSystemEntry Properties

Property Name	Data Type	Property Mode	Description
name	**EntryName**	mandatory, **fixed_readonly**	Simple name relative to parent **Directory**
path	**EntryPath**	optional, **fixed_readonly**	Full pathname relative to initial **FileSession Directory**.
owner	**wstring**	optional, **fixed_readonly**	If defined, the owner of the **Entry**.
creation_time	**TimeBase::UtcT**	optional, **fixed_readonly**	If defined, the entry creation time.
modification_time	**TimeBase::UtcT**	optional, **fixed_readonly**	If defined, the last time the entry was modified.

A mandatory property is one that a service implementation must always allow a client to access. An optional property is one that a service implementation may restrict a client’s access to, may not provide a value for a particular **File** or **Directory**, or not provide at all. For purposes of discussion, the properties from the above list and any other implementation defined properties that a specific client is allowed access to are called *client accessible* properties.

The behavior of the **CosProperties::PropertySet** methods specific to **FileSystemEntry** objects are:

define_property	For a read only *client accessible* property, a **CosProperties::ReadOnlyProperty** exception will be raised. If the property is not client accessible, a **CosProperties::UnsupportedProperty** is raised
define_properties	An implementation will behave as for **define_property**, except that the exception raised is **CosProperties::MultipleExceptions** containing **PropertyException** structs having **reason** codes of **read_only_property** or **unsupported_property**.

:

get_number_of_properties	An implementation must not include any non client accessible properties in the return count. The returned count may be less than the total number of properties associated with the **FileSystemEntry**.
get_all_property_names	An implementation must not include any non client accessible properties in the returned sequence. The returned sequence size may be less than the total number of properties associated with the **FileSystemEntry**.
get_property_value	For all client accessible properties that a value is defined for, the property value is returned. Otherwise the exception **PropertyNotFound** is raised.
get_properties, get_all_properties	For all client accessible properties that a value is defined for, the property is returned. All other properties will denote an exception by appearing in the return sequence with a type of **tk_void** as described in the CosProperty Service specification.
delete_property delete_properties delete_all_properties	For all fixed client accessible properties, an exception denoting **fixed_property** shall be raised. For **delete_all_properties**, client accessible fixed properties will not be deleted and the operation shall return true.

3.1.4.2 *FileSystemEntry Methods*

The next sections describe the methods available on the **FileSystemEntry** interface.

3.1.4.3 *get_name*

Returns the simple name for this **FileSystemEntry**. This is the same value returned by the name property.

Return Value

EntryName for the **FileSystemEntry**.

3.1.4.4 get_path

Returns the path name for this **FileSystemEntry** relative to the initial **Directory** returned from **FileSystem::login**. This is the same value returned by the path property.

Return Value

EntryPath for the **FileSystemEntry**.

Exceptions

A **FileSystemError** may be raised for an implementation defined reason. No specific **ErrorCode** values are defined.

3.1.4.5 exists

Report the existence of a **FileSystemEntry** on the **FileSystem**.

Return Value

- TRUE - The **FileSystemEntry** exists on the **FileSystem**.
- FALSE - The **FileSystemEntry** does not exist on the **FileSystem**.

Exceptions

A **FileSystemError** may be raised for an implementation defined reason. No specific **ErrorCode** values are defined.

3.1.4.6 get_parent

Returns the parent **Directory** for this **FileSystemEntry**.

Exceptions

A **FileSystemError** may be raised with an **ErrorCode** value of:

- **NO_PERMISSION** - If the client is not allowed to access the parent **Directory**. Many implementations will raise this exception if **get_parent** is called on the initial **Directory** returned from **FileSystem::login**.

3.1.4.7 get_session

Returns the associated **FileSession** for this **FileSystemEntry**.

Exceptions

A **FileSystemError** may be raised with an **ErrorCode** value of:

- **NO_PERMISSION** - If the client is not allowed to access the **FileSession** from this **FileEntry**.

3.1.4.8 remove

This operation removes the entry from the service. A **Directory** may only be removed if it is empty. Once removed an **Entry** will not appear in a listing of its parent directory.

Exceptions

A **FileSystemError** is raised on error. The following **ErrorCode** values are defined:

- **NO_PERMISSION** - If the client is not allowed to remove this **Entry**.
- **DIR_NOT_EMPTY** - If this is a **Directory** and contains child entries.
- **ENTRY_PATH_ERROR** - If the **Entry** does not exist.

3.1.4.9 destroy

This operation releases the **FileSystemEntry** object. It does not **remove** the entry's representation from the **FileSystem**. A client should call **destroy** on an **Entry** when it has finished with it.

3.1.5 Directory Interface

The **Directory** interface represents a collection of **File** and **Directory** entries. The interface defines operations to list and obtain references to these entries. The IDL is:

```
interface Directory:  FileSystemEntry {

DirEntryIterator list(in CosPropertyService::PropertyNames listProps)
    raises (FileSystemError);

Directory create_directory(in EntryPath fpath)
    raises( FileSystemError);

 File get_file(in EntryPath fpath, in boolean must_exist)
    raises( FileSystemError);

 Directory get_directory(in EntryPath fpath)
    raises( FileSystemError);

 void remove_entry(in EntryPath fpath)
    raises( FileSystemError);
};
```

3.1.5.1 Directory Properties

In addition to the properties for **FileSystemEntry**, **Directory** objects have one additional property listed in Table 3-2.

Table 3-2 Directory Properties

Property Name	Data Type	Property Mode	Description
num_children	**DirEntryCount**	optional, fixed_readonly	The number of entries in the Directory. In some cases it is not practical to provide this value directly. In this case the directory must be iterated through to count the entries.

3.1.5.2 list

The list operation allows a client to iterate through a set of **Directory** entries and their properties.

Parameters

- **list-props** - A sequence containing the names of the desired entry properties. A service implementation is not required to return all the properties requested.

Return value

A **DirEntryIterator** (see Section 3.1.6, “DirEntryIterator Interface,” on pa ge3-11). If the **DirEntryIterator** value is **nil**, there were no entries to return. If the value is **non-nil** there may or may not be entries to be retrieved.

An implementation is not required to return sequence members that represent the current or parent **Directory** entries.

The properties returned are dependent on client permissions and whether an entry has a value for the property. If a client does not have permission to retrieve a property, an implementation must not raise an exception with an **ErrorCode** of **NO_PERMISSION**. The denied property shall be silently omitted.

Exceptions

FileSystemError - The following **ErrorCode** value is defined:

- **NO_PERMISSION** - The client is not permitted to obtain the **Directory** list.

3.1.5.3 create_directory

This operation creates a child **Directory**. It is similar to the familiar mkdir command.

Parameters

- **dir_path** - The **Path** of the **Directory** to create. This **EntryPath** is relative to the **Directory**. If **dir_path** contains more than one component, the intermediate directories will be created as well.

Return value

The newly created **Directory**.

Exceptions

A **FileSystemError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR**. - If any component of the path is invalid or one of the intermediate components is a **File**.
- **NO_PERMISSION** - If the client is not allowed to create or access any component of the **dir_path**.
- **ENTRY_EXISTS** - If this **Directory** already exists.

3.1.5.4 *get_file*

This operation returns a **File** for the specified **Path**.

Parameters

- **file_path** - The **File**'s **Path** relative to the **Directory**.
- **must_exist** - If TRUE, the operation will only succeed if the file already exists on the **FileSystem**.

Return value

A **File** reference for the file.

Exceptions

A **FileSystemError** may be raised with the following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If any component of the path is invalid or one of the intermediate components is a **File**. If the **must_exist** parameter is true and the file does not exist.
- **NO_PERMISSION** - If the client is not allowed to access any component of the **file_path**.

3.1.5.5 *get_directory*

This operation returns a **Directory** corresponding to an existing directory.

Parameters

- **dir_path** - The relative **EntryPath** for the **Directory**.

Return value

The requested **Directory**.

Exceptions

A **FileSystemError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If any component of the path is invalid or one of the intermediate components is a **File**, or the **Directory** does not exist.
- **NO_PERMISSION** - If the client is not allowed to access any component of the **dir_path**.

3.1.5.6 *remove_entry*

This operation removes a **File** or **Directory** entry. If the entry is a **Directory**, it must be empty before it can be removed.

Parameters

- **entry_path** - The relative **EntryPath**.

Exceptions

A **FileSystemError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If any component of the path is invalid or one of the intermediate components is a **File**.
- **NO_PERMISSION** - If the client is not allowed to access any component of the path.

3.1.6 *DirEntryIterator Interface*

The **DirEntryIterator** interface is used to iterate through the results of a **Directory::list** operation. The IDL is:

```
// Directory listing size and list offset

typedef unsigned long long DirEntryCount;
typedef unsigned long long DirEntryOffset;

// Directory listing Types

typedef short DirEntryType;
const DirEntryType FILE_ENTRY = 0;
const DirEntryType DIR_ENTRY  = 1;

struct DirEntry {
EntryName name;
DirEntryType type;
CosPropertyService::Properties props;
```

```
};

typedef sequence<DirEntry> DirEntrySeq;

interface DirEntryIterator {
    DirEntrySeq next(in DirEntryOffset from_dir_entry,
                     in DirEntryCount max_dir_entries)
        raises (FileSystemError);
    void destroy();
};
```

3.1.6.1 Related Types

DirEntryType

This type defines the type of an entry, either **DIR_ENTRY**, or **DIR_FILE**.

DirEntry

Directory::list returns **FileSystemEntry** information in **DirEntry** structures. The fields of this struct are:

- name - The simple (single component) name of the entry in this **Directory**.
- type - The **DirEntryType** of the entry.
- props - A sequence containing the requested entry properties.

DirEntrySeq represents a sequence of **DirEntry**.

DirEntryCount, DirEntryOffset

These types are used to control the iteration through a **Directory**.

- **DirEntryCount** - The maximum number of entries to return to the client.
- **DirEntryOffset** - The offset into the **Directory**'s entry list from which the **DirEntryCount** applies.

See "next" below for details on the use of these types.

3.1.6.2 next

This operation returns a sequence of **DirEntry**. The **DirEntryIterator** is a recoverable iterator and allows a client to repeat a failed call to **next**, requesting a smaller sequence in the event of an exception.

Parameters

- **from_entry_number** - return entries starting from the specified entry number.
- **max_dir_entries** - The maximum number of entries to return to the client. If the value is zero value, there is no upper bound.

In normal operation **next** is called repeatedly until all the directory entries are returned. The first time **next** is called, **from_entry_number** must be zero. For subsequent calls, the value of **from_entry_number** is set to its previous value plus the length of the returned entry sequence.

In the event that a call to **next** results in an exception indicative of resource exhaustion on either the client or the server, such as **NO_MEMORY**, the client can retry the **next** operation by invoking **next** with the previous **from_entry_number** and a smaller **max_dir_entries** value.

If the **next** operation fails with a **max_dir_entries** value of one, the iteration cannot be completed and the client must handle the error.

Return value

A **DirEntrySeq** with a length of up to **max_dir_entries** for non-zero values of **max_dir_entries**. If **max_dir_entries** is zero, the returned sequence length is implementation defined. In either case, an implementation may not return a **DirEntrySeq** of length zero unless there are no further entries to retrieve.

Exceptions

A **FileSystemError** may be raised with the following **ErrorCode** value:

- **UNSUPPORTED** - If the **from_entry_number** parameter is illegal for the current iterator state.

3.1.6.3 *destroy*

After a client is finished with a **DirEntryIterator**, **destroy** should be called to release the internal resources held by the service implementation.

3.1.7 *File Interface*

The IDL is:

```
interface File: FileSystemEntry {

void copy(in File dest)
    raises( TransferError);

void append(in File dest)
    raises( TransferError);

void insert(in File dest, in FileOffset offset)
    raises( TransferError);

TransferEndPoint create_end_point(in TransferEndPointRole ep_role,
                                  in FilePos seek,
                                  in FileOffset offset,
                                  in TransferProtocol ep_protocol)
```

```
        raises (FileSystemError);

    TransferProtocolSeq get_end_point_protocols();
};
```

3.1.7.1 File Properties

In addition to the properties for **FileSystemEntry**, **File** objects have one additional property listed in Table 3-3.

Table 3-3 File Properties

Property Name	Data Type	Property Mode	Description
size	**FileSize**	Optional, **fixed_readonly**	The size of the file in octets. In some implementations it may not be practical to determine the size of an entity being represented by a File. In this case the property is not provided.

3.1.7.2 copy

The **copy** operation copies the contents of this **File** to the destination **File**. If the destination **File** currently exists, it is overwritten.

Parameters

- **dest** - The destination (sink) **File**.

Exceptions

A **TransferError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If any component of a File is invalid or one of the intermediate components is a **File**.
- **NO_PERMISSION** - If the client cannot access any component of a file path
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing a file.
- **TRANSFER_IO_ERROR** - There was an error in opening, closing, reading, or writing a data connection.
- **TRANSFER_ABORT** - The transfer was aborted.

3.1.7.3 append

The **append** operation appends the contents of this **File** to the destination **File**.

Parameters

- **dest** - The destination **File**.

Exceptions

A **TransferError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If the sink **File** does not exist. If any component of a **File** is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If the sink **File** does not allow an append.
- **NO_PERMISSION** - If the client cannot access any component of a file path
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing a file.
- **TRANSFER_IO_ERROR** - There was an error in opening, closing, reading, or writing a data connection.
- **TRANSFER_ABORT** - The transfer was aborted.

3.1.7.4 insert

The **insert** operation inserts the contents of the **File** at the specified offset in the destination **File**.

Parameters

- **dest** - The destination **File**.
- **file_offset** - The **FileOffset** into the destination **File**.

Exceptions

A **TransferError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If the sink **File** does not exist. If any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If the sink **File** does not allow an insert.
- **NO_PERMISSION** - If the client cannot access any component of a file path
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing a file or the file_offset parameter is larger than the sink **File** size.
- **TRANSFER_IO_ERROR** - There was an error in opening, closing, reading, or writing a data connection.
- **TRANSFER_ABORT** - The transfer was aborted.

3.1.7.5 *create_end_point*

The **create_end_point** method is used to create a **TransferEndPoint** (see Section 3.1.8, “TransferEndPoint Interface,” on page 3-17), which is used by a service to implement the high level **copy**, **append**, and **insert** operations. Clients performing more complex transfer operations may also make use of this method.

Parameters

- **ep_role** - Specifies whether the role of the **TransferEndPoint** is to read or write the File’s contents. Values are **TransferEndPointRole::SOURCE**, **TransferEndPointRole::SINK, and TransferEndPointRole::SINK_INSERT**. **TransferEndPointRole::SINK** will overwrite and truncate to the last written octet.
- **file_pos** - Specifies whether the data transfer will be relative to the beginning or end of the **File**. Values are **FilePos::BEGIN** and **FilePos::END**.
- **offset** - The offset from the **file_pos** to begin reading or writing.
- **ep_protocol** - Specifies the type of **TransferEndPoint** to be created. The specification currently defines transfer protocols using CORBA interfaces, FTP, and FTAM. See Section 3.1.8, “TransferEndPoint Interface,” on page 3-17 for details.

Return value

TransferEndPoint for use in a single transfer of the File. The **TransferEndPoint** should be destroyed after use.

Exceptions

A **TransferError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If the **SOURCE** file does not exist. If any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If an unsupported **ep_protocol** is specified.
- **NO_PERMISSION** - If the client cannot create the **TransferEndPoint**.
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing a file.
- **TRANSFER_IO_ERROR** - There was an error in opening, closing, reading, or writing a data connection.

3.1.7.6 *get_end_point_protocols*

Obtains a sequence of supported transfer protocols for this **File**. An implementation is not required to provide the same transfer protocols for all **Files**. An implementation may also change the set of available transfer protocols for a **File** if there are no **TransferEndPoints** for that **File** in existence at the time of the change.

Return value

TransferProtocolSeq listing supported protocols. The sequence is in preferred protocol order.

An implementation is not required to return the CORBA interface "**IDL:omg.org/CosFileTransfer/OctetTransferIterator:1.0**" since it is mandatory. An implementation may choose to return it in the list to indicate a preference over other protocols.

3.1.8 TransferEndPoint Interface

TransferEndPoint objects represent a **File** during a transfer operation. The IDL is:

```
interface TransferEndPoint;
typedef wstring TransferProtocol;
typedef sequence<TransferProtocol> TransferProtocolSeq;

typedef short TransferEndPointRole;

const TransferEndPointRole SOURCE      = 0;
const TransferEndPointRole SINK        = 1;
const TransferEndPointRole SINK_INSERT= 2;

// transfer protocol specific information

typedef wstring TransferDetail;

typedef short TransferState;
const TransferState CREATE      = 0;
const TransferState LISTEN      = 1;
const TransferState CONNECT     = 2;
const TransferState ACTIVE      = 3;
const TransferState COMPLETE    = 4;
const TransferState ABORT       = 5;

struct TransferStatus {
TransferState state;            // current transfer state
FileCount current_count;        // current transfer count
FileCount max_count;            // expected transfer size bytes/chars
};

interface TransferEndPoint
{
    TransferDetail go_to_listen()
        raises(FileSystemError);

    TransferDetail connect_to_peer(in TransferDetail passive_detail)
        raises(FileSystemError);

    void set_peer(in TransferDetail active_detail)
```

```
        raises(FileSystemError);

    TransferStatus get_transfer_status()
        raises (FileSystemError);

    void transfer()
        raises (FileSystemError);

    void abort()
        raises (FileSystemError);

    void destroy();
};
```

3.1.8.1 Related Types

TransferProtocol

A string type that identifies a transfer protocol such as “FTP.” **TransferProtocolSeq** is the sequence typedef for **TransferProtocol**.

TransferDetail

This is a string type with a format that is specific to the transfer protocol used. During connection negotiation, **TransferEndPoints** exchange protocol information in **TransferDetails**.

TransferState

An enumeration that provides state information about a **TransferEndPoint**. The defined states are:

- **CREATE** - Initial state after creation.
- **LISTEN** - waiting for an active connection, **go_to_listen** has been called.
- **CONNECT** - connected to its peer, either **connect_to_peer**, or **set_peer** has been called.
- **ACTIVE** - data transfer has started.
- **COMPLETE** - data transfer completed successfully.
- **ABORT** - data transfer error.

TransferStatus

This struct provides information about the progress of a transfer that a **TransferEndPoint** is involved in. The fields are:

- **state** - the **TransferState** for the endpoint.

- **current_count** - expected transfer size. If this is unknown or not provided by the service implementation, it is set to zero. This value is usually available from the source endpoint but not the sink.
- **max_count** - For a source endpoint this is the octets sent. For a sink endpoint this is the octets received. In the case of a transfer error this value represents the transfer count before the abort. If the value is unknown or not provided by the service implementation, it is set to zero.

3.1.8.2 *go_to_listen*

This method is called on the passive **TransferEndPoint** to establish the listening side of a data connection. On return the **TransferEndPoint** is ready to accept an active connection. This is the first step in negotiating a transfer connection.

Return value

TransferDetail describing the passive **TransferEndPoint** details. For example in the case of a CORBA protocol transfer, the returned **TransferDetail** would be an **IOR** string, and for an FTP transfer, "**host:port**."

Exceptions

A **TransferError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If a file does not exist, any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If an invalid **active_detail** is specified for those protocols that use this parameter or this method is called on an active **TransferEndPoint**.
- **NO_PERMISSION** - If the client does not have the proper credentials to perform the operation.
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing the file associated with the **TransferEndPoint**.
- **TRANSFER_IO_ERROR** - There was an error in opening, closing, reading, or writing the data connection.

3.1.8.3 *connect_to_peer*

This method is called on an active **TransferEndPoint** to make the connection to the passive **TransferEndPoint**. This is the second step in negotiating a transfer connection.

Parameters

- **passive_detail** - This **TransferDetail** provides the required details to allow the active **TransferEndPoint** to connect to the passive **TransferEndPoint**. This parameter is set to the return value from the **go_to_listen** call on the passive **TransferEndPoint**.

Return value

TransferDetail describing the active **TransferEndPoint** details.

Exceptions

A **TransferError** may be raised with following **ErrorCode** values:

- **ENTRY_PATH_ERROR**. If a file does not exist. If any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If an invalid **passive_detail** is specified for those protocols that use this parameter or this method is called on an active **TransferEndPoint**.
- **NO_PERMISSION** - If the client does not have the proper credentials to perform the operation.
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing the file associated with the **TransferEndPoint**.
- **TRANSFER_IO_ERROR** - There was an error in opening, closing, reading, or writing the data connection.

3.1.8.4 set_peer

This method is called on the passive **TransferEndPoint** to complete the transfer connection negotiation. It is the final step in negotiating a transfer connection. It allows the passive **TransferEndPoint** to obtain any remaining **TransferDetail** about the active end of the connection. The use of this information is protocol dependent.

Parameters

- **active_detail** - This **TransferDetail** provides information about the active end of the data connection to the passive **TransferEndPoint**. The value of this parameter is set to the result of the **connect_to_peer** operation.

Exceptions

A **TransferError** may be raised with the following **ErrorCode** values:

- **ENTRY_PATH_ERROR**. If a file does not exist. If any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If an invalid **active_detail** is specified for those protocols that use this parameter or this method is called on an active **TransferEndPoint**.
- **NO_PERMISSION** - If the client does not have the proper credentials to perform the operation.
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing the file associated with the **TransferEndPoint**.
- **TRANSFER_IO_ERROR** - There was an error in opening, closing, reading, or writing the data connection.

3.1.8.5 *get_transfer_status*

This method returns the status of the **TransferEndPoint**.

Exceptions

A **FileSystemError** may be raised. The following specific **ErrorCode** value is defined.

- **UNSUPPORTED** - If a service implementation does not provide this information.

3.1.8.6 *transfer*

Transfer the **File** contents between the source and sink **TransferEndPoints**. This method is called on the source **TransferEndPoint**.

Exceptions

A **FileSystemError** may be raised. The following specific **ErrorCode** value is defined.

- **UNSUPPORTED** - If this operation is called on a sink **TransferEndPoint**.

3.1.8.7 *abort*

This method causes the **TransferEndPoint** to terminate the current **transfer** operation the transfer at its end of the connection. The other **TransferEndPoint** will see the abort an unexpected termination of the transfer operation or connection.

An implementation may not be able to abort a transfer or even respond to the request until the current transfer is complete.

Exceptions

A **FileSystemError** may be raised. The following specific **ErrorCode** value is defined.

- **UNSUPPORTED** - If it is not possible to abort the transfer operation.

The system exception **BAD_INV_ORDER** will be raised if **abort** is called on a transfer that has not yet started, is already completed, or has aborted.

3.1.8.8 *destroy*

This method closes a transfer, releasing any internal resources the **TransferEndPoint** has obtained. Further invocations on this object will receive an **OBJECT_NOT_EXIST** exception.

3.1.9 OctetTransferIterator Interface

The **OctetTransferIterator** interface allows for transfer of a **File**'s contents using only CORBA calls and without requiring another **File** object to transfer to or from. **OctetTransferIterator** is a recoverable iterator. It does not provide random access to a **File**'s contents.

The IDL is:

```
typedef unsigned long long FileLength;
typedef unsigned long long FileOffset;
typedef unsigned long long FileCount;
typedef sequence<octet> FileOctetSeq;

interface OctetTransferIterator {

    FileOctetSeq get_octet_seq(in FileOffset from_octet, in FileCount max_octets)
        raises (FileSystemError);

    void put_octet_seq(in FileOffset to_octet, in FileOctetSeq octetSeq)
        raises(FileSystemError);

    void destroy()
        raises(FileSystemError);

};
```

3.1.9.1 Related Types

FileOffset

This type represents an offset into a **File**'s contents. Normally an **OctetTransferIterator** is created by a **TransferEndPoint**, in which case an **OctetTransferIterator's FileOffset** values are relative to the **FileOffset** specified when the **TransferEndPoint** was created (**File::create_end_point**).

FileCount

This type represents a **File** octet count. It is used to represent **File** size and the number of octets transferred.

FileOctetSeq

An octet sequence representing the binary contents of a **File**.

3.1.9.2 get_octet_seq

This operation returns the next unread sequence of **File** octets.

Parameters

- **from_octet** - return octets starting from the specified offset.
- **max_octets** - The maximum number of octets to return. If the value is zero, there is no upper bound.

In normal operation **get_octet_seq** is called repeatedly until all **File** octets are returned. The first time **get_octet_seq** is called, **from_octet** is set to zero. For subsequent calls, the value of **from_octet** is set to its previous value plus the length of the returned sequence of **File** octets.

If **get_octet_seq** raises an exception that may be indicative of resource exhaustion on either the client or server such as **NO_MEMORY**, the client can retry the failed read by invoking **get_octet_seq** with the previous **from_octet** and a smaller **max_octets**.

If **get_octet_seq** fails with a **max_octets** value of one, the get iteration cannot be completed and the client must handle the error.

Exceptions

A **FileSystemError** may be raised with the following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If a file does not exist. If any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If this **TransferOctetIterator** does not allow reads.
- **NO_PERMISSION** - If the client does not have the proper credentials to perform the operation.
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing the file.
- **TRANSFER_ABORT** - An associated **TransferEndPoint** has been aborted.

3.1.9.3 put_octet_seq

This operation writes an octet sequence to a **File**.

Parameters

- **octet_offset** - write octets starting at the specified offset.
- **octet_seq** - The octet sequence to write.

In normal operation **put_octet_seq** is called repeatedly until all the **File** octets are transferred. The first time **get_octet_seq** is called, **from_octet** is set to zero. For subsequent calls, the value of **octet_offset** is set to its previous value plus the length of the previous **octet_seq**.

If **put_octet_seq** raises an exception indicative of resource exhaustion on either the client or server such as **NO_MEMORY**, the client can retry the operation by invoking **put_octet_seq** with the previous **octet_offset** and a smaller **octet_seq**.

If **put_octet_seq** fails with an **octet_seq** length of one, the put iteration cannot be completed and the client must handle the error.

Exceptions

A **FileSystemError** may be raised with the following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If a file does not exist. If any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **UNSUPPORTED** - If the **TransferOctetIterator** does not allow writes.
- **NO_PERMISSION** - If the client does not have the proper credentials to perform the operation.
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing the file.
- **TRANSFER_ABORT** - An associated **TransferEndPoint** has been aborted.

3.1.9.4 destroy

After a client is finished with an **OctetTransferIterator**, **destroy** must be called to complete the transfer and gracefully release any associated resources held by the service implementation. Further calls to the iterator will raise an **OBJECT_NOT_EXIST**.

Exceptions

A **FileSystemError** may be raised with the following **ErrorCode** values:

- **ENTRY_PATH_ERROR** - If a file does not exist. If any component of a **File** path is invalid or one of the intermediate components is a **File**.
- **ENTRY_IO_ERROR** - There was an error in opening, closing, reading, or writing the file.

If **destroy** raises a **FileSystemError**, the **OctetTransferIterator** is still destroyed.

3.2 Object Lifecycle

All of the interfaces except for **FileSystem** have a **destroy** operation. After the **destroy** method is invoked, any further operations on the object reference will raise an **OBJECT_NOT_EXIST**.

A client should invoke **destroy** on an object after use is complete to allow a service implementation to reclaim resources. An implementation is free to reap objects at any time in order to reclaim resources.

Clients should expect that any operation on a **CosFileTransfer** object may raise an **OBJECT_NOT_EXIST** as a server may reclaim an object, particularly if inactive, at anytime.

3.3 Conformance Criteria

3.3.1 Interfaces

A service implementation must provide all of the interfaces defined in this specification. An implementation is not required to support the following operations on all **Files** or **TransferEndPoints**:

- **File::append**
- **File::insert**
- **TransferEndPoint::abort**
- **TransferEndPoint::get_transfer_status**

If an implementation does not support these operations on a given object it must raise a **FileSystemError** exception with an **ErrorCode** value of **UNSUPPORTED**.

3.3.2 Transfer Protocols

A service implementation must support transfers using the corba interface "**IDL:omg.org/CosFileTransfer/OctetTransferIterator:1.0**". All other protocols are optional.

Complete OMG IDL *A*

```
//File: CosFileTransferFTF.idl

#ifndef _COS_FILE_TRANSFER_IDL_
#define _COS_FILE_TRANSFER_IDL_
#include <CosProperty.idl>

#pragma prefix “omg.org”

module CosFileTransfer {

   // FileEntry types

   interface Directory;
   interface File;

   // FileSystem login session

   interface FileSession;


   // Filesystem entries, Files and Directories,
   // have multi-component path names

   typedef wstring EntryName;
   typedef sequence<EntryName> EntryPath;

   // File size, offset, octet count, and contents

   typedef unsigned long long FileLength;
   typedef unsigned long long FileOffset;
   typedef unsigned long long FileCount;
   typedef sequence<octet> FileOctetSeq;

   typedef short FilePos;
   const FilePos BEGIN = 0; // FileOffset is relative to beginning of File
   const FilePos END   = 1; // FileOffset is relative to end of File
```

```
// Directory listing size and list offset

typedef unsigned long long DirEntryCount;
typedef unsigned long long DirEntryOffset;


// Directory listing Types

typedef short DirEntryType;
const DirEntryType FILE_ENTRY = 0;
const DirEntryType DIR_ENTRY  = 1;

struct DirEntry {
   EntryName name;
   DirEntryType type;
   CosPropertyService::Properties props;
};

typedef sequence<DirEntry> DirEntrySeq;

interface DirEntryIterator;


// TransferEndPoint Types

interface TransferEndPoint;
typedef wstring TransferProtocol;
typedef sequence<TransferProtocol> TransferProtocolSeq;

typedef short TransferEndPointRole;

const TransferEndPointRole SOURCE = 0;
const TransferEndPointRole SINK = 1;
const TransferEndPointRole SINK_INSERT = 2;

// transfer protocol specific information

typedef wstring TransferDetail;

typedef short TransferState;
const TransferState CREATE  =  0; // the end point has been created (initial state)
const TransferState LISTEN  =  1; // the end point is awaiting active connection
const TransferState CONNECT =  2; // the end point is connected to its peer
const TransferState ACTIVE  =  3; // the transfer is in progress
const TransferState COMPLETE = 4; // transfer has completed succesfully
const TransferState ABORT =  5; // transfer has been aborted

struct TransferStatus {
   TransferState state;         // current transfer state
   FileCount current_count; // current transfer count
   FileCount max_count;     // expected transfer size bytes/chars
};
```

```
// Exceptions

typedef short ErrorCode;
const ErrorCode UNSPECIFIED= 0; // Error category not defined
const ErrorCode UNAVAILABLE  = 1; // The service is not available at this time
const ErrorCode UNSUPPORTED = 2; // operation not supported, illegal parameter value
const ErrorCode NO_PERMISSION   = 3; // No permission to perform the operation
const ErrorCode ENTRY_EXISTS  = 4; // Entry should not already exist for operation
const ErrorCode ENTRY_PATH_ERROR  = 5; // Entry path component missing or invalid
const ErrorCode ENTRY_IO_ERROR   = 6; // error opening, reading, writing, closing file
const ErrorCode DIR_NOT_EMPTY   = 7; // (rmdir required empty directory)
const ErrorCode TRANSFER_IO_ERROR = 8; // error opening, transferring, or closing connections
const ErrorCode TRANSFER_ABORT  = 9;

exception FileSystemError {
   ErrorCode error;
   wstring desc;
};

// Error transferring between two files

exception TransferError {
   TransferEndPointRole error_endpoint;
   ErrorCode error;
   wstring desc;
};

// FileSystem provided by service

interface FileSystem {

   FileSession login(in wstring user,
                     in wstring password,
                     in CosPropertyService::Properties login_properties,
                     out Directory initial_dir)
      raises(FileSystemError);

   wstring get_system_id();
};

// FileSession client obtains by logging in to FileSystem

interface FileSession {
   void destroy();
};


// Common File system entry methods

interface FileSystemEntry: CosPropertyService::PropertySet {

   EntryName get_name()
      raises (FileSystemError);

   EntryPath get_path()
```

```
        raises (FileSystemError);

    boolean exists()
        raises (FileSystemError);

    void remove()
        raises (FileSystemError);

    Directory get_parent()
        raises (FileSystemError);

    FileSession get_session()
        raises (FileSystemError);

    void destroy();
};

interface File;

// Directory manipulation and listing

interface Directory:  FileSystemEntry {

    DirEntryIterator list(in CosPropertyService::PropertyNames listProps)
        raises (FileSystemError);

    Directory create_directory(in EntryPath fpath)
        raises( FileSystemError);

    File get_file(in EntryPath fpath, in boolean create)
        raises( FileSystemError);

    Directory get_directory(in EntryPath fpath)
        raises( FileSystemError);

    void remove_entry(in EntryPath fpath)
        raises( FileSystemError);
};

// Iterator to retrieve results of Directory list

interface DirEntryIterator {
    DirEntrySeq next(in DirEntryOffset from_dir_entry,
                     in DirEntryCount max_dir_entries)
        raises (FileSystemError);
    void destroy();
};


// File manipulation and basic transfer

interface File: FileSystemEntry {

    void copy(in File dest)
        raises( TransferError);
```

```
    void append(in File dest)
      raises( TransferError);

    void insert(in File dest, in FileOffset offset)
      raises( TransferError);

    TransferEndPoint create_end_point(in TransferEndPointRole ep_role,
                                      in FilePos seek,
                                      in FileOffset offset,
                                      in TransferProtocol ep_protocol)
      raises (FileSystemError);

    TransferProtocolSeq get_end_point_protocols();
};


// File transfer

interface TransferEndPoint
{
    TransferDetail go_to_listen()
      raises(FileSystemError);

    TransferDetail connect_to_peer(in TransferDetail passive_detail)
      raises(FileSystemError);

    void set_peer(in TransferDetail active_detail)
      raises(FileSystemError);

    TransferStatus get_transfer_status()
      raises (FileSystemError);

    void transfer()
      raises (FileSystemError);

    void abort()
      raises (FileSystemError);

    void destroy();
};

// File transfer using an iterator

interface OctetTransferIterator {

    FileOctetSeq get_octet_seq(in FileOffset from_octet, in FileCount max_octets)
      raises (FileSystemError);

    void put_octet_seq(in FileOffset to_octet, in FileOctetSeq octetSeq)
      raises(FileSystemError);

    void destroy()
      raises(FileSystemError);
```

```
    };
};
#endif //_COS_FILE_TRANSFER_IDL_
```

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