INTERNATIONAL STANDARD

ISO/IEC 14478-3

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Information technology — Computer graphics and image processing — Presentation Environment for Multimedia Objects (PREMO) —

Part 3:
Multimedia Systems Services

Technologies de l'information — Infographie et traitement d'images — Environnement de présentation d'objets multimédia (PREMO) —

Partie 3: Services pour les systèmes multimédia

Reference number
ISO/IEC 14478-3:1998(E)

Contents

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, government and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee ISO/IEC JTC1. Draft International Standards adopted by the joint technical committees are circulated to the national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

ISO/IEC 14478-3 was prepared by Joint Technical Committee ISO/IEC JTC1, *Information technology*, Subcommittee SC24, *Computer graphics and image processing*.

This International Standard currently consists of the following four parts under the general title *Information technology — Computer graphics and image processing — Presentation environments for multimedia objects (PREMO)*:

— *Part 1: Fundamentals of PREMO*

— *Part 2: Foundation Component*

— *Part 3: Multimedia Systems Services*

— *Part 4: Modelling, Rendering, and Interaction Component*

Annex A forms an integral part of this part of ISO/IEC 14478. Annexes B to D are for information only.

Introduction

The Multimedia Systems Services (MSS) component of PREMO provides a standard set of services that can be used by multimedia application developers in a variety of computing environments. Enabling multimedia applications in a heterogeneous, distributed computing environment is the design motivation for the MSS. This is an increasingly prevalent computing model, and a solution that meets the needs of this environment can more easily be scaled to stand–alone systems than vice versa.

The principal reasons for defining the MSS are:

a) provide abstractions and mechanisms that make it possible for applications to deal with the problems of distributed multimedia computing successfully;

b) facilitate the implementation of complex applications, such as video conferencing;

c) provide abstractions that make it possible for applications to deal with media devices without regard to specific characteristics of the platform, attached devices, or the network(s) connecting the platforms and devices;

d) to provide a standard methodology, especially for handling "live" data;

e) insure scalability to large organizations;

f) insure adequate performance in adverse conditions;

g) facilitate Quality of Service commitments; and

h) consider the time critical nature of the data.

The primary goal of the MSS is to provide an infrastructure for building multimedia computing platforms that support interactive multimedia applications dealing with synchronized, time–based media in a heterogeneous distributed environment. Operation in a distributed environment is important because of significant trends in the computer industry towards client/server and collaborative computing. Another significant trend is towards multimedia enabled computing. The inevitable result will be an intersection of these trends to produce a distributed multimedia environment with a topology similar to Figure 1.

The MSS is intended to address a broad range of application needs. It extends the multimedia capabilities of stand-alone computers to capabilities that are usable both locally and remotely. The Multimedia Systems Services gives applications the ability to handle:

i) live data remotely;

j) stored data remotely;

k) both live and stored data simultaneously;

l) multiple kinds of data simultaneously; and

m) new kinds of devices and media types.

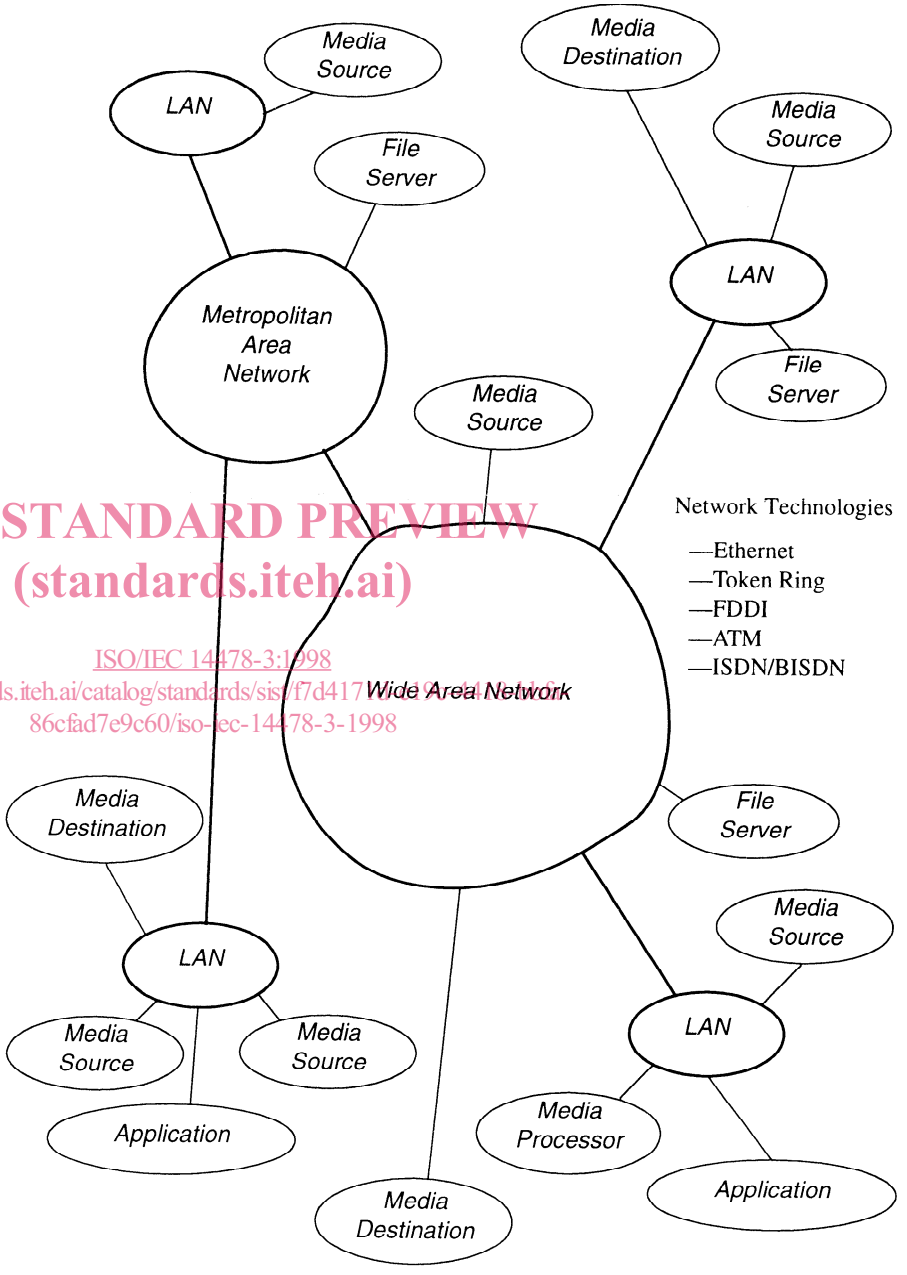


Figure 1 — Distributed multimedia environment

To provide support for remote media device control and remote media access that derive from the above application scenarios, the Multimedia System Services uses two distinct mechanisms. To support interaction with remote objects, the Multimedia Systems Services depends upon an underlying object model and infrastructure, as described in ISO/IEC 14478–1 (PREMO). To support the media independent streaming of time critical data, the Multimedia Systems Services defines a Media Stream Control.

The MSS does not address:

n) encryption and security;

o) intellectual property rights and accounting;

p) scripting;

q) user interfaces; or

r) sharing of data between applications.

Information technology — Computer graphics and image processing — Presentation Environment for Multimedia Objects (PREMO) — Part 3: Multimedia Systems Services

1 Scope

This part of ISO/IEC 14478 defines a standard set of multimedia system services that can be used by multimedia application developers in a variety of computing environments. The focus is on enabling multimedia applications in a heterogeneous, distributed computing environment. Throughout this part of ISO/IEC 14478, this component will also be referred to as "Multimedia Systems Services", and abbreviated as MSS.

The Multimedia Systems Services constitutes a framework of "middleware" — system software components lying in the region between the generic operating system and specific applications. As middleware, the Multimedia Systems Services marshals lower–level system resources to the task of supporting multimedia processing, providing a set of common services which can be used by multimedia application developers.

The Multimedia Systems Services encompasses the following characteristics:

a) provision of an abstract type for a media processing node, extensible through subtyping to support abstractions of real media processing hardware or software;

b) provision of an abstract type for the data flow path or the connection between media processing nodes, encapsulating low–level connection and transport semantics;

c) grouping of multiple processing nodes and connections into a single unit for purposes of resource reservation and stream control;

d) provision of a media dataflow abstraction, with support for a variety of position, time and/or synchronization capabilities;

e) separation of the media format abstractions from the dataflow abstraction;

f) synchronous exceptions and asynchronous events;

g) application visible characterization of object capabilities;

h) registration of objects in a distributed environment by location and capabilities;

i) retrieval of objects in a distributed environment by location and constraints;

j) definition of a Media Stream Protocol to support media independent transport and synchronization.

The Multimedia Systems Services rely on the object model of ISO/IEC 14478-1 (Fundamentals of PREMO) and the object types and non–object data types defined in ISO/IEC 14478-2 (PREMO Foundation Component).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 14478. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of this international standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 14478-1:1998, *Information technology — Computer graphics and image processing — Presentation Environment for Multimedia Objects (PREMO) — Part 1: Fundamentals of PREMO.*

ISO/IEC 14478-2:1998, *Information technology — Computer graphics and image processing — Presentation Environment for Multimedia Objects (PREMO) — Part 2: Foundation Component.*

ISO/IEC 14478-4:1998, *Information technology — Computer graphics and image processing — Presentation Environment for Multimedia Objects (PREMO) — Part 4: Modelling, Rendering, and Interaction Component.*

ISO/IEC 10918-1:1994, *Information technology — Digital Compression and Coding of Continuous–Tone Still Images (JPEG).*

ISO/IEC 11172:1992, *Information technology — Coding of Moving Pictures and Associated Audio for Digital Storage Media at up to about 1.5Mbit/s (MPEG).*

3 Definitions

3.1 PREMO Part 1 definitions

This part of ISO/IEC 14478 makes use of all terms defined in ISO/IEC 14478-1 (Fundamentals of PREMO).

3.2 PREMO Part 2 definitions

This part of ISO/IEC 14478 makes use of all terms defined in ISO/IEC 14478-2 (PREMO Foundation Component).

3.3 Additional definitions

For the purposes of this part of ISO/IEC 14478, the following definitions apply.

3.2.1 configuration objects: Collective name for format, quality of service descriptor, and media stream protocol objects.

3.2.2 jitter: Delay variance.

3.2.3 processing element (for virtual devices): Conceptual entity describing the internal behaviour of virtual device objects.

3.2.4 virtual connection adapter: Conceptual entity describing the configuration process performed by a virtual connection object.

3.2.5 unicast connection: One–to–one connection; an output port may be connected to one input port only, and an input port may be connected to one output port only.

3.2.6 multicast connection: One–to–many connection; an output port may be connected to several input ports, and an input port may be connected to several output ports.

The following alphabetical list gives the subclause of each definition.

multicast connection	3.2.6
processing element (for virtual devices)	3.2.3
unicast connection	3.2.5
virtual connection adapter	3.2.4

4 Symbols and abbreviations

ATM:	Asynchronous Transfer Mode.
CATV:	Cable TV
DMA:	Direct Memory Access.
FSM:	Finite State Machine.
IEC:	International Electrotechnical Commission.
IS:	International Standard.
ISO:	International Organization for Standardization.
JPEG:	Joint Picture Experts Group.
LAN:	Local Area Network
MIDI:	Musical Instrument Digital Interface
MPEG:	Moving Picture Experts Group.
MSS:	Multimedia Systems Services
PREMO:	Presentation Environment for Multimedia Objects.
QoS:	Quality of Service.
TCP:	Transmission Control Protocol.
UDP:	User Data Protocol.
RTP:	Real–Time Protocol

5 Conformance

A conforming implementation of the PREMO Multimedia Systems Services shall comply with the general conformance rules defined in clause 5 of ISO/IEC 14478-1 and the component specification in clause 11 of This part of ISO/IEC 14478.

6 Overview of the Multimedia Systems Services

6.1 Introduction

This clause presents several comprehensive views of the Multimedia Systems Services, which, taken together, represent a broad, architectural summary. These views include:

a) an object interaction diagram, which characterizes the dynamic relationships among instantiated objects and to illustrate client visible interfaces;

b) a subtyping diagram, which describes the subtyping hierarchy among MSS objects;

c) a short description of the life cycle of Multimedia Systems Services objects.

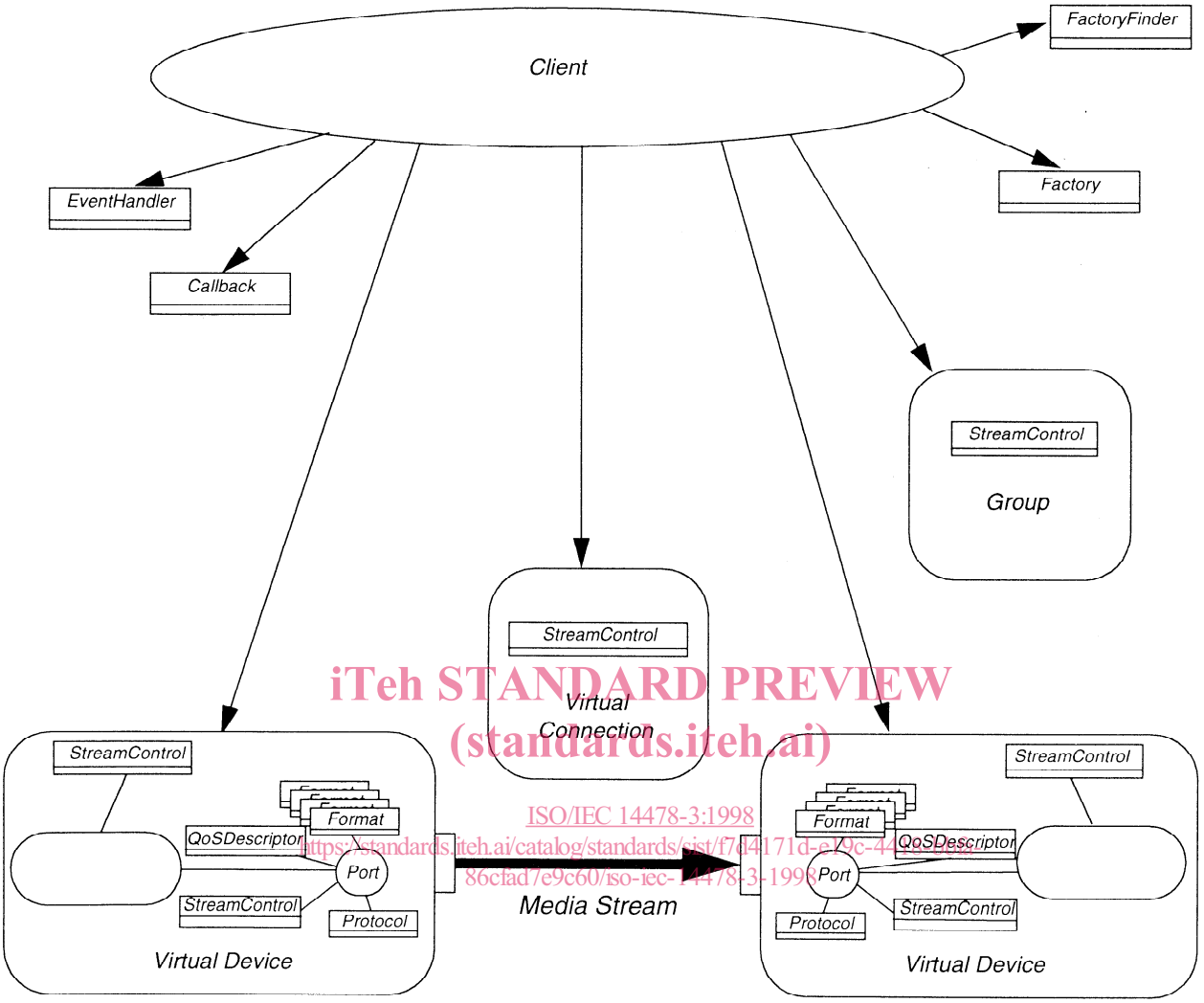


Figure 2 — Multimedia system services client interaction

A somewhat larger example of how the various MSS objects may be used is also given in Annex B.

6.2 Object framework

Figure 2 on page 4 summarizes the interactions between Multimedia Systems Services framework objects and a client; Figure 3 on page 6 summarizes the interaction among framework objects. As seen in Figure 2, only a subset of the objects and interfaces are actually visible to a client of MSS. In particular, much of the interaction between the virtual connection and other objects in the framework is not client visible. This part of ISO/IEC 14478 is concerned primarily with client visible interfaces; implementations may extend these interfaces for implementation–specific reasons, to comply with the behaviour of the objects, as defined in this standard.

Figure 2 is suggestive, rather than realistic, since the objects shown are abstract types, rather than concrete types which would normally be instantiated. Also, object creation and destruction are not shown in this diagram.

In Figure 2, the client is communicating with a small dataflow graph, comprised of two virtual devices and a virtual connection. A group object, which assists the client, is also shown. The client interacts with the objects indicated by the arrows. Each of these objects may be local or remote.

Each virtual device is a processing node in the dataflow graph. The nature of the processing (capture, encoding, filtering, etc.) varies according to the specific object (and is implemented by subtyping). Each virtual device contains a stream control object and one or more format objects shown by the boxes in the shaded areas. Virtual connections and groups also have an associated stream object and this association is represented similarly. These associations are referred to as inclusion. Although not explicitly shown in the diagram, the client interacts directly with the included stream and format interfaces.

A stream control object provides the client with an interface to observe media stream position in various terms (as a function of media transport, media samples, or logical time; see clause 8). Stream control objects also provide synchronization operations. Stream control objects do *not* perform the effective transfer of media data; they merely act as an entry for the clients to control media flow.

In addition to a stream control, a virtual device also contains one or more ports, describing an input or output mechanism for the virtual device. Ports are framework abstractions that do not have a client–visible interface. Virtual devices provide operations to select a specific port, using an abstract non–object data type as an opaque handle.

Just as the stream control object allows a media stream control abstraction which is separable from media processing, the format object provides an abstraction of the details of media formatting which is separate from both processing and flow–control. For example, the details of a frame–dependent video encoding, like MPEG, would be represented by a subtype of format.

The virtual connection provides operations to create a connection between an output port of one virtual device and an input port of another, fully encapsulating low–level transport semantics. Virtual connections also provide support for multicast connections. An included stream object provides operations for controlling the dataflow on the virtual connection.

The group object, shown in Figure 2, provides assistance to the client to manage the dataflow graph of the two virtual devices and the virtual connection. A group object provides a convenient mechanism for atomic resource allocation and specification of end–to–end Quality of Service (QoS) values for the whole graph. The group object gives access to a stream object, through which the client can control dataflow for the encapsulated graph.

Multimedia Systems Services objects are instantiated by factories. A factory provides the client facilities to select among the various objects that the factory is capable of creating. A client can also use the factory finder service to find a reference to a factory capable of instantiating an object whose properties satisfy a list of constraints.

A client can register interest in receiving specific events produced by the various objects. This is done using the callback mechanism and the event model as described in ISO/IEC 14478-2 (part 2 of PREMO).

Figure 3 shows the internal connections between MSS objects. For the most part, the client is unaware that these connections exist, and this part of ISO/IEC 14478 will not focus on the low–level details of these connections and their relevant interfaces. They are shown here to help explain the Multimedia Systems Services architecture. The primary purpose of most of the internal connections is to off–load work from the client. Note, for example, that the virtual connection interacts with the formats of both the source and target virtual devices.This allows the virtual connection to match those formats without client intervention. The group and the stream associated with the group provide similar assistance to the client; the group can assist in resource allocation, while the associated stream can assists in stream control. The dashed arrows show that the objects send events to the client via the event handler.

6.3 Subtyping diagram

Another view of the MSS Architecture is given in Figure 4 on page 7. This is a simplified subtyping diagram for the MSS objects which does not contain all object types defined in this part of ISO/IEC 14478 neither their full type graph; the reader should refer to Annex A for a more complete diagram.

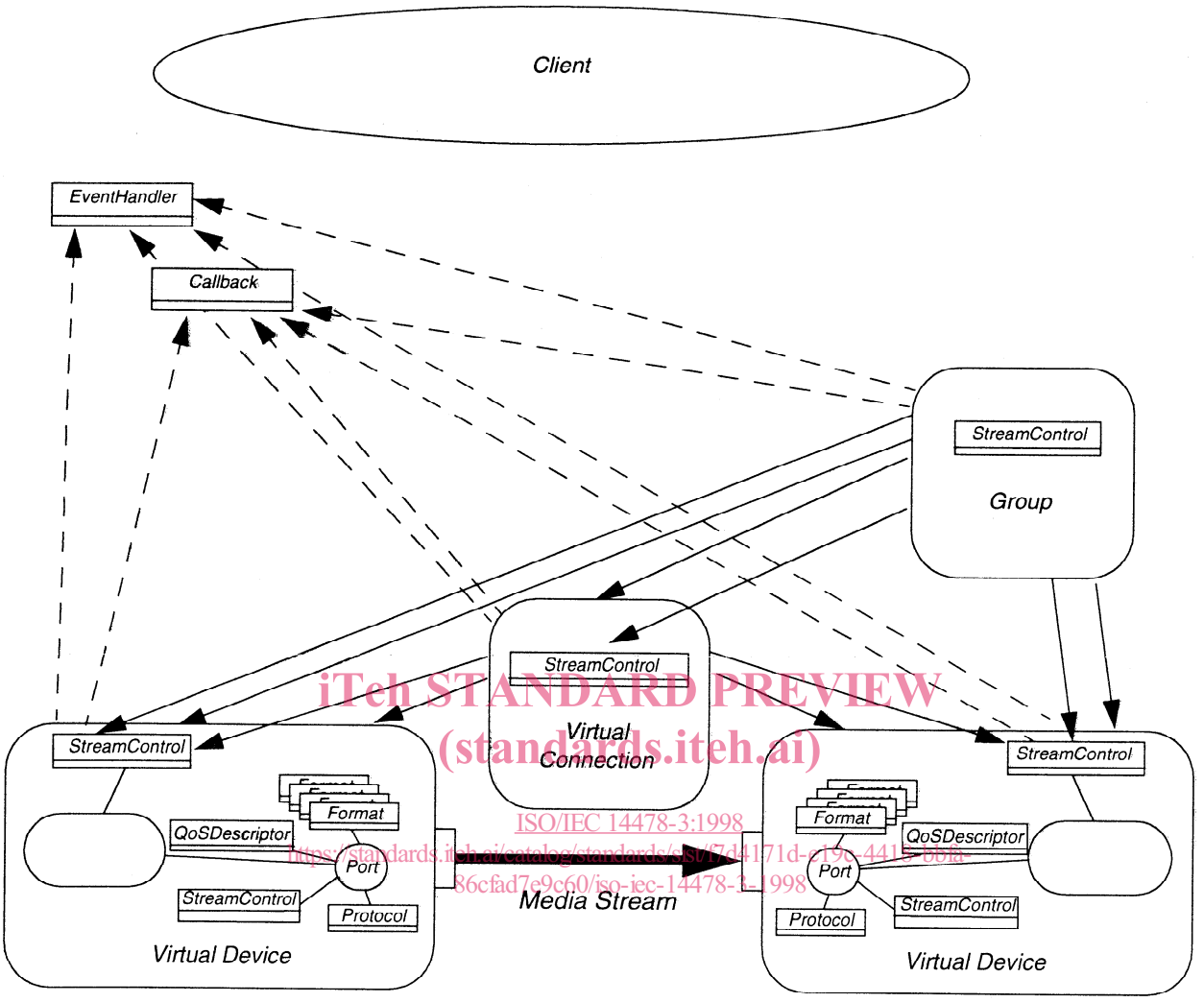


Figure 3 — Multimedia system services internal interfaces

The types in the diagram will be discussed in detail elsewhere in this part of ISO/IEC 14478. For the time being the only important characteristic to note is that all types defined in MSS are subtypes of *EnhancedPREMOObject* (see ISO/IEC 14478-2), thereby inheriting all features described in the Foundation Component of PREMO. Also, all objects are subtypes of *PropertyInquiry*, which is further described in 8.1.2 of ISO/IEC 14478-2 (part 2 of PREMO).

6.4 MSS object life cycle

Figure 5 on page 7 gives a schematic view of the life cycle of an MSS object and its reference. Beyond the basic life cycle of PREMO objects, as described in ISO/IEC 14478-1, all MSS objects rely on the concepts of factories and factory finders defined in the extended profile of ISO/IEC 14478-2 (see 8.2.1 of ISO/IEC 14478-2 for a detailed description of these facilities), which encapsulate normal object and object reference creation. The client has the ability to create objects through these factories by specifying constraints on the capabilities of the object to be created (e.g., media formats it can process, quality of service it can provide, etc.). The client receives from the factory an object reference to an object obeying these requirements. This object reference goes then through the life cycle as described in 8.11 of ISO/IEC 14478-1.

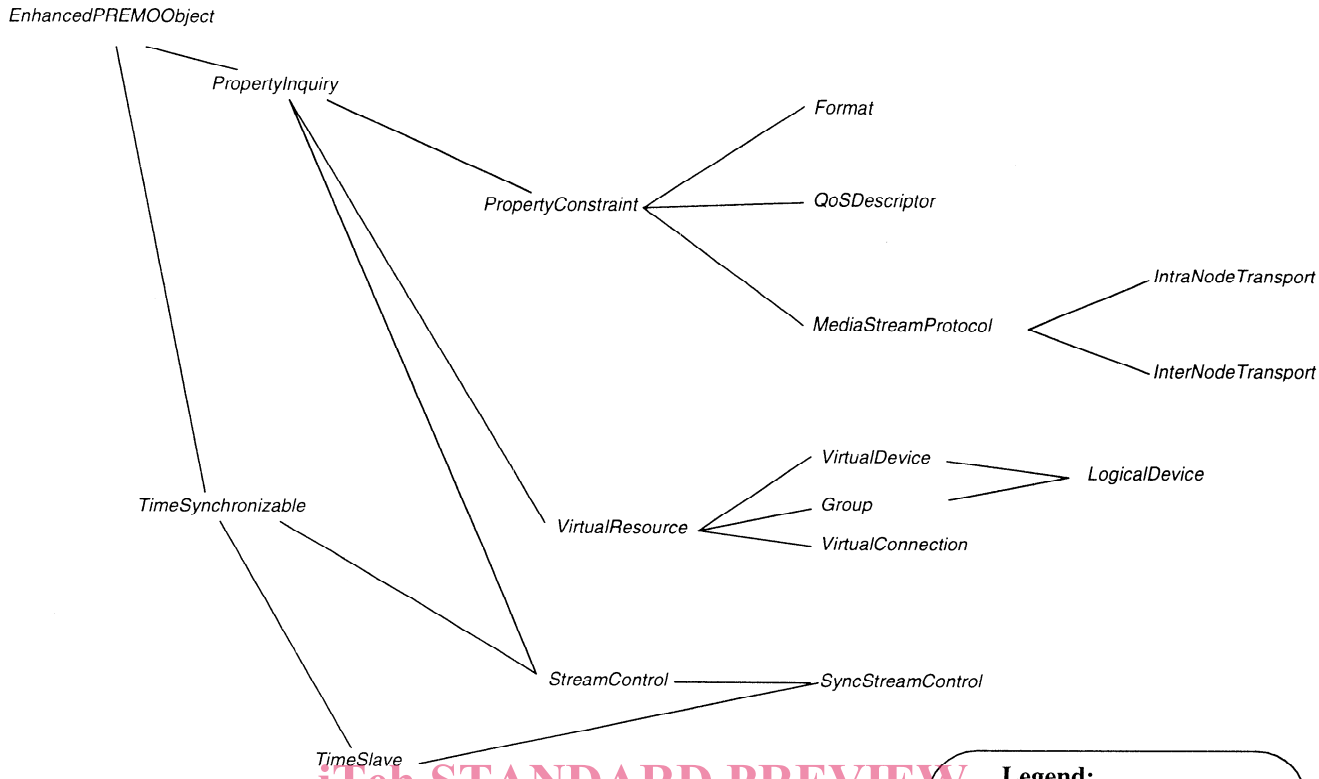
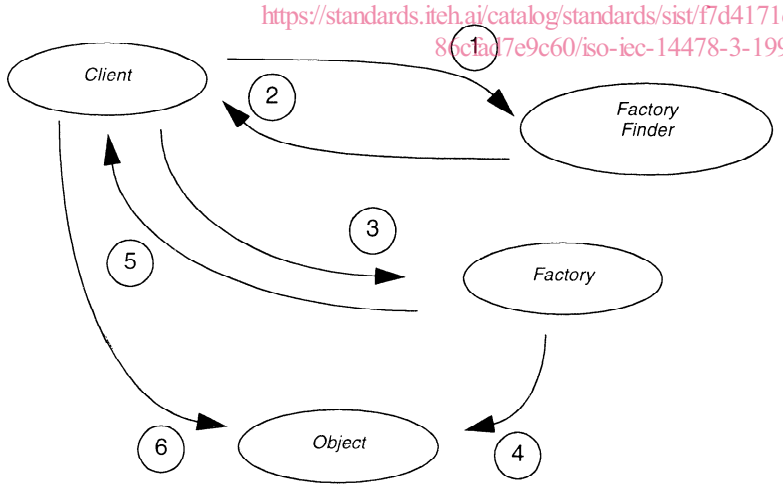


Figure 4 — Subtyping diagram



1. *Client requests a reference to a factory capable of satisfying a capability list passed as parameter.*
2. *Factory Finder returns a Factory reference*
3. *Client requests the creation of an object from the Factory, with a constraint list on the object to be created.*
4. *Factory possibly creates the object…*
5. *…and returns the reference to its client.*
6. *Later, the client destroys the reference, which eventually leads to the destruction of the object.*

Figure 5 — MSS Object life cycle