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Edition 1.0 2012-02

INTERNATIONAL STANDARD

**Information technology – Home electronic system (HES) architecture –
Part 5-6: Intelligent grouping and resource sharing for HES Class 2 and Class 3 –
Service type**



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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 5-6: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Service type

FOREWORD

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International Standard ISO/IEC 14543-5-6 was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

The list of all currently available parts of the ISO/IEC 14543 series, under the general title *Information technology – Home electronic system (HES) architecture*, can be found on the IEC web site.

This International Standard has been approved by vote of the member bodies, and the voting results may be obtained from the address given on the second title page.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

INTRODUCTION

ISO/IEC 14543-5, Information technology – Home electronic system (HES) architecture – Part 5: Intelligent Grouping and Resource Sharing for HES (IGRS), consists of six parts:

➤ **IGRS Part 5-1: Core protocol**

- Specifies the TCP/IP protocol stack as the basis and the HTTP protocol as the message-exchanging framework among devices.
- Specifies a series of device and service interaction/invocation standards, including device and service discovery protocol, device and service description, service invocation, security mechanisms, etc.
- Specifies core protocols for a type of home network that supports streaming media and other high-speed data transport within a home.

➤ **IGRS Parts 5-2#: Application profile**

- Based on the IGRS Core Protocol.
- Specifies a device and service interaction mechanism, as well as application interfaces used in IGRS basic applications.
- Multiple application profiles are specified, including:
 - Part 5-21: AV profile
 - Part 5-22: File profile
- Additional application profiles are planned (part numbers to be assigned)
 - Part 5-2w: DVD profile
 - Part 5-2x: QoS profile
 - Part 5-2y: DMCP profile
 - Part 5-2z: Universal control profile

➤ **IGRS Part 5-3: Basic application**

- Includes an IGRS basic application list.
- Specifies a basic application framework.
- Specifies operation details (device grouping, service description template, etc.), function definitions and service invocation interfaces.

➤ **IGRS Part 5-4: Device validation**

- Defines a standard method to validate an IGRS-compliant device.

➤ **IGRS Part 5-5: Device type**

- Specifies IGRS Device types used in IGRS applications.

➤ **IGRS Part 5-6: Service type**

- Specifies basic service types used in IGRS applications.

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE –

Part 5-6: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Service type

1 Scope

This part of ISO/IEC 14543-5 specifies the service types that conform to ISO/IEC 14543-5-1.

This part of the ISO/IEC 14543 is applicable to computers, household appliances and communication devices that implement media or data streaming in a local area network (LAN) or personal area network (PAN) environment by wired or wireless means.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document, including any amendments, applies.

ISO/IEC 14543-5-1:2010, *Information technology – Home electronic system (HES) architecture – Part 5-1: Intelligent grouping and resource sharing for Class 2 and Class 3 – Core protocol*

ISO/IEC 14543-5-21,— *Information technology – Home electronic system (HES) architecture – Part 5-21: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Application profile – AV profile*

ISO/IEC 14543-5-22:2010, *Information technology – Home electronic system (HES) architecture – Part 5-22: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Application profile – File profile*

ISO/IEC 29341-3-1:2008, *Information technology – UPnP Device Architecture – Part 3-1: Audio Video Device Control Protocol – Audio Video Architecture*

IETF RFC 2046, *Multipurpose Internet Mail Extensions (MIME) – Part 2: Media Types*

3 Terms, definitions, abbreviations and conventions

3.1 Terms and definitions

For the purposes of this document the following terms and definitions apply.

3.1.1

audio/video multicast device group

type of media device group consisting of a media server and media client with multicast capability for an AV multicast playback application

3.1.2

centralised device group

set of IGRS devices with one IGRS device acting as the master

NOTE The master is responsible for managing the setup, for dismissing a Device Group and for processing a join request from other devices. The master device and other IGRS Devices in such a Device Group form a centralised or master-slave relationship.

3.1.3

client identifier

unique identifier associated with a Client on an IGRS Device to which that Client belongs

3.1.4

content index service device group

type of media device group consisting of multiple media servers for managing content across multiple media servers in a distributed, collaborative and load-balancing manner

3.1.5

device group

multiple IGRS devices that are organised in a logical group through the device group management mechanism in the IGRS specification

NOTE Each IGRS device in a Device Group follows common interaction rules. Two types of Device Groups are defined: peer-to-peer Device Group and centralised (master-slave) Device Group.

3.1.6

device identifier

globally unique device identifier associated with one IGRS Device

3.1.7

device pipe

channel used to transfer device interaction messages

NOTE This channel is set up through the pipe setup mechanism in the IGRS specification.

3.1.8

IGRS client

application that draws upon the services of one or more connected IGRS Devices

NOTE Multiple client instances can exist on a network at the same time.

3.1.9

IGRS device

information device that conforms to the IGRS specification

3.1.10

IGRS dynamic service invocation module

part of the AV application logic to orchestrate the interaction of application services with respect to the capability of the device or device group involved and to coordinate the service invocation sequence between the media server and media client

NOTE The IGRS dynamic service invocation module should be implemented on a media server, a media client or a another separate device.

3.1.11

IGRS service

sharable resource encapsulated in an IGRS Device by implementing application interfaces and providing services for other IGRS Devices

NOTE An IGRS Service has an invocation interface that meets the requirements of the IGRS specification. These invocation interfaces are described and announced on the network through the IGRS Service Description Specification.

3.1.12

IGRS user

owner of an IGRS Device and Client

3.1.13

media client

audio/video device in an IGRS network that possesses multimedia decoding capability

NOTE Examples of a media client device include a TV, set top box, etc. The media client may access content on the media server as the destination device in an audio/video application.

3.1.14

media device group

embodiment of device group in an audio/video system and a type of centralised device group defined in ISO/IEC 14543-5-1

NOTE A media device group consists of two classes: content index service device group and audio video multicast device group.

3.1.15

media server

audio/video device in IGRS network that possesses storage and computing capability

NOTE Examples of a media server device include a PC, network storage server, etc. The media server may provide a network interface to other audio/video devices to access content managed by the media server as the source device in an audio/video application.

3.1.16

peer-to-peer device group

set of IGRS Devices where each IGRS Device in this set has a peer-to-peer relationship with one another

3.1.17

service attribute

variable associated with each service type to record the service status

3.1.18

service identifier

unique identifier assigned to a service provided by a specific IGRS Device

NOTE The same type of service may be provided by multiple IGRS Devices within the same network. Each instance of a service has a unique service identifier on the IGRS Device providing that service.

3.1.19

service interface

method provided by IGRS service for the IGRS clients to share resources

NOTE The service interface is composed of interface name, parameters provide by IGRS clients, etc.

3.1.20

service type

category of IGRS Service defined according to the set of resources encapsulated

NOTE The Service Type enables service applications in the same category to have common invocation interfaces.

3.1.21**service type identifier**

global unique identifier to differentiate IGRS services and identify the operation methods and eventing mechanism of certain services

3.1.22**user identifier**

identifier of an IGRS user

3.2 Abbreviations

BCM	Back Channel Message
CIS	Content Index Service
CMS	Connection Management Service
EPG	Electronic Program Guide
FAMS	File Access Management Service
FC	File Client
FCMS	File Connection Management Service
FS	File Server
IGRS	Intelligent Grouping and Resource Sharing
MAN	Mandatory, also refer to message definitions in ISO/IEC 14543-5-1
MCTMS	Media Client Transport Management Service
MP	Media Player
MR	Media Recorder
MS	Media Server
MSTMS	Media Server Transport Management Service
RMS	Rendering Management Service

3.3 Conventions

For the convenience of the implementer, a number of XML schemas specified in this standard can also be found on the World Wide Web. In case of any differences, the definitions within this standard shall prevail.

4 Conformance

For conformity to this International Standard the following applies.

- The IGRS generic service model shall meet the general description specification described in Clause 5.
- The IGRS service type identifier requirements shall meet the specifications described in Clause 6.
- The list of all standard IGRS service types and their detailed service-related functional requirements shall conform to meet the specification defined in Clauses 7 and 8 respectively.
- The Back Channel Message TCP Service definitions shall meet the specification defined in Clause 9.
- The content representation framework requirements for an IGRS AV application shall meet the specifications described in Annex A.
- The description requirements for metadata used in an IGRS AV application shall meet the specifications described in Annex B.

- The data type generation requirements for all IGRS services shall meet the specifications described in Annex C.
- The specific service type message formats for all IGRS services shall meet the specifications described in Annex D.
- The XML schema files used in the IGRS services shall meet the specifications described in Annex E.
- The service description wsdl files used in the IGRS services shall meet the specifications described in Annex F, Annex G, Annex H, Annex I and Annex J, respectively.

5 IGRS service overview

An IGRS service conforms to the Core Protocol and indicates the shared resource provided by IGRS devices. An IGRS service is published based on the service description template and mechanism specified by the the Core Protocol and can be invoked by IGRS clients through the operation mechanism specified by the Core Protocol.

An IGRS service is classified into many types. The service instances implementing the same service type should provide the same invocation interface and eventing mechanism. The service type is uniquely defined by the relevant service attribute and interface set.

This standard defines in detail a series of basic service types in the next few clauses. The description includes the relevant service type identifier, service attribute, service interface set and service implementation flow.

6 Definition of service type identifier

An IGRS service type can be classified into standard service type and non-standard service type.

Standard service type identifiers shall conform to the service type identifier definition in the Core Protocol, see 8.2.3 of ISO/IEC 14543-5-1:2010. According to the service type identifier definition in the Core Protocol, the syntax of the standard service type identifier shall be as follows:

```
<IGRSServiceTypeURN>::="urn:"<IGRSNS>":"<IGRSIDVAL>
<IGRSNS>::="IGRS:Service:ServiceType"
<IGRSIDVAL>::=1*<URN chars>
<URN chars>::=<trans>
<trans>::=<upper>|<lower>|<number>|<other>
<upper>::="A"|"B"|"C"|"D"|"E"|"F"|"G"|"H"|"I"|"J"|"K"|"L"|"M"|"N"|"O"|"P"
|"Q"|"R"|"S"|"T"|"U"|"V"|"W"|"X"|"Y"|"Z"
<lower>::="a"|"b"|"c"|"d"|"e"|"f"|"g"|"h"|"i"|"j"|"k"|"l"|"m"|"n"|"o"|"p"|"q"|"r"|"s"
|"t"|"u"|"v"|"w"|"x"|"y"|"z"
<number>::="0"|"1"|"2"|"3"|"4"|"5"|"6"|"7"|"8"|"9"
<other>::="-"|"."|"_"
The value <URN chars> is case insensitive.
```

A non-standard service type is a service type not defined by this standard but by the developer of the product. Non-standard service type identifiers shall conform to the servicetype identifier syntax definition in the Core Protocol, see 8.2.3 of ISO/IEC 14543-5-1. According to the service type identifier definition in the Core Protocol, the syntax of the non-standard service type identifier shall be as follows:

```
<IGRSSelfDefineServiceTypeURN>::="urn:"<IGRSNS>":"<IGRSIDVAL>
<IGRSNS>::="IGRS:service:servicetype-p"
<IGRSIDVAL>::=1*<URN chars>
<URN chars>::=<trans>
```

```

<trans>::=<upper> | <lower> | <number> | <other>
<upper>::="A" | "B" | "C" | "D" | "E" | "F" | "G" | "H" | "I" | "J" | "K" | "L" | "M" | "N" | "O" | "P"
| "Q" | "R" | "S" | "T" | "U" | "V" | "W" | "X" | "Y" | "Z"
<lower>::="a" | "b" | "c" | "d" | "e" | "f" | "g" | "h" | "i" | "j" | "k" | "l" | "m" | "n" | "o" | "p" | "q" | "r" | "s"
| "t" | "u" | "v" | "w" | "x" | "y" | "z"
<number>::="0" | "1" | "2" | "3" | "4" | "5" | "6" | "7" | "8" | "9"
<other>::="-" | "." | "_"
The value <URN chars> is case insensitive.

```

Unless specified in the document, the word “service type” shall have the meaning of “standard service type”.

7 Standard service type list

A standard service type includes the following services: Content Index Service, Connection Management Service, Media Server Transport Management Service, Media Client Transport Management Service, Rendering Management Service, File Access Management Service and File Connection Management Service.

Table 1 defines a series of the current basic service types. Clause 8 specifies the details of the service types listed in Table 1.

Table 1 – Basic service type list

Service type name	Service type identifier	Field explanation
Content Index Service	Urn:IGRS:Service:ServiceType:ContentIndex:1	The Content Index Service allows the IGRS dynamic service invocation module to discover and list the media content on a media server so that the IGRS dynamic service invocation module can retrieve the content information, including the name, creation date, size, format, etc. of the media content. This information can be used by the IGRS dynamic service invocation modules to determine whether these contents can be played on a media client. The content directory structure supports nesting of sub-directories.
Connection Management Service	Urn:IGRS:Service:ServiceType:ConnectionManagement:1	The Connection Management Service is used to create and manage the connection between media client and media server. The Media server and media client can support and manage several active connections at any one time by the Connection Management Service.
Media Server Transport Management Service	Urn:IGRS:Service:ServiceType:MediaServerTransportManagement:1	The Media Server Transport Management Service enables IGRS dynamic service invocation modules to adjust and to control the media stream transport on the media server, such as play, pause, stop, seek, etc. If this service exists, it means that the media server initiated out-of-band transport model is supported. Otherwise, it is not supported.
Media Client Transport Management Service	Urn:IGRS:Service:ServiceType:MediaClientTransportManagement:1	The Media Client Transport Management Service enables an IGRS dynamic service invocation module to adjust and to control the transport of media stream on a media client, such as play, pause, stop, seek, etc. If this service exists, it means that the media client initiated out-of-band transport model is supported. Otherwise, it is not supported.
Rendering Management Service	Urn:IGRS:Service:ServiceType:RenderingManagement:1	The Rendering Management Service allows an IGRS dynamic service invocation module to control media playing, such as volume, contrast, brightness, etc. Multiple active instances of rendering control can be supported, such as the "picture-in-picture" function in TV. The New Rendering Management Service instance is created by the PrepareForConnection of Connection Management Service on a media client. This service is only provided by a media client.
File Access Management Service	Urn:IGRS:Service:ServiceType:FileAccessManagement:1	The File Access Management Service provides the following functions to a File Client: - it provides authentication for a File Client and thus gives corresponding file access rights to the File Client; - it allows a File Client to retrieve a sorting/searching capability supported by a File Server; - it allows a File Client to browse the content directory in the network provided by the File Server; - it allows a File Client to search a specified file/directory; - it allows a File Client to retrieve and modify attributes of a file/directory; - it allows a File Client to retrieve and set a browsing filter; - it allows a File Client to subscribe to a file/directory object update event; - it allows a File Client to subscribe to a File Access Management Service update event; - it supports a File Client to upload and download the specified file/directory.
File Connection Management Service	Urn:IGRS:Service:ServiceType:FileConnectionManagement:1	The File Connection Management Service is used to create and manage the connection between a File Server and a File Client. A File Server can support and manage multiple active connections at any one time through the File Connection Management Service.

8 Basic service type specification

8.1 Content index service

8.1.1 Overview

A content Index Service allows an IGRS dynamic service invocation module to discover and list the media content on a media server so that the IGRS dynamic service invocation module can retrieve the content information, including the name, creation date, size, format, etc. of media content. This information can be used by the IGRS dynamic service invocation module to determine whether this content can be played on a media client. The content directory structure supports nesting of sub-directories. A more detailed description of the IGRS AV content directory is found in Annex A of this standard (refer also to ISO/IEC 29341-3-1:2008).

8.1.2 Content index service type

Content Index Service Type is defined as:

urn:IGRS:Service:ServiceType:ContentIndex:1.

8.1.3 Content index service attribute

The Content Index Service Attribute is shown in Table 2.

Table 2 – Service attribute of content index service

Name of service attribute	Data type	Field explanation
ContentUpdateId	Type_ContentUpdateId	Changes with any modification to the content object on media server. Used to notify the IGRS dynamic service invocation module that the content object has changed.
SortCaps	Type_SortCapabilityList	List of content object attributes, used to sort the result of searching and browsing.
ObjectId	Type_ObjectId	Media object to be subscribed.
TransferInstanceIds	Type_TransferInstanceIds	List of IDs of media transfer.

Subscription and notification of update of a service attribute of the Content Index Service shall follow the general service attribute subscription and notification rules specified in the IGRS core protocol.

8.1.4 Data type of content index service

The Data Type of Content Index Service is shown in Table 3.

Table 3 – Data type of content index service

Name of data type	Data type	Field explanation
Type_ObjectId	String	Unique ID used to identify a media content object. See Clause C.1 for a specific definition on Type_ObjectId.
Type_ContentList	XML Schema struct	List result of media files. See Clause C.2 for a specific definition on Type_ContentList.
Type_AttributeList	XML Schema struct	List of metadata attribute of media content object.
Type_FilterRule	String	Search filtering rule of media content. See Clause C.3 for a specific definition on Type_FilterRule.
Type_BrowseFlag	String	Indicates the options when browsing the content directory. The legal values are: CONSTANT_CONTAINERSELFINFO – indicates the attribute of a specified content object to be returned as a result; CONSTANT_CONTAINERCHILDRENINFO – indicates the children item attribute of the specified content object to be returned as a result.
Type_SortRule	String	Indicates the sorting rule of the media content attribute list. See Clause C.4 for a specific definition of Type_SortRule.
Type_Count	Int	Indicates the number of content items.
Type_TransferInstanceId	UnsignedInt	Identifies specific transfer file.
Type_TransferInstanceIds	UnsignedInt list	List of transfer IDs.
Type_TransferState	String	Indicates the current state of the file transfer. It can be: "IN_PROGRESS", "STOPPED", "COMPLETED" or "ERROR".
Type_Length	String	Indicates the size of the media object in bytes.
Type_TagList	XML Schema struct	Tag data list in XML format.
Type_URI	String	URI. See Clause C.5 for a specific definition of Type_URI.
Type_SearchCapabilityList	String list	The Attribute name list settable as searching condition. A null string means that CIS doesn't support any searching of a content object attribute. "*" means that CIS supports all searching of content object attributes.
Type_SortCapabilityList	String list	The Attribute name list that can be sorted as the result of searching or browsing. A null string means that CIS doesn't support any sorting of content object attributes. "*" means that CIS supports all sorting of content object attributes.
Type_ContentUpdateId	UnsignedInt	Indicates whether the media content has been updated. This value changes with any modification to any content object of CIS. It is used to notify an IGRS dynamic service invocation module if any change to the content is made.
Type_SearchAttributeName	String	Media object attribute name.
Type_AttributeValueList	XML Schema struct	Media object attribute value list.
Type_MediaFormat	XML Schema struct	Media format. See Clause C.6 for a specific definition of Type_MediaFormat.
Type_UserList	XML Schema struct	List of users. See Clause C.7 for a specific definition of Type_UserList.

8.1.5 Invocation interface set of content index service

8.1.5.1 GetSearchCapabilityList

Function description: Retrieves the searching capability supported by CIS on a media server.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
SearchCaps	Output	Type_SearchCapabilityList	The Attribute list of a content object that can be used as a searching condition. A null string means that CIS does not support any searching of a content object attribute. "" means that CIS supports all searching of content object attributes.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.2 GetSortCapabilityList

Function description: Retrieves the sorting list supported by CIS on a media server.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
SortCaps	Output	Type_SortCapabilityList	The Attribute list of a content object that can be sorted as the searching or browsing result. A null string means that CIS does not support any sorting of content object attributes. "" means that CIS supports all sorting of content object attributes.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.3 GetAttributeValueSearchCapabilityList

Function description: Retrieves the capability of searchable attribute values supported by CIS on a media server.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
SearchAttributeValueCaps	Output	Type_AttributeList	Used to indicate the searchable attribute value list of a media object. If the list contains only one Attribute element and its value is empty, then it means that CIS does not support any searching of a content object attribute value. If the list contains only one Attribute element and its value is "", then it means that CIS supports all searching of content object attribute values.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.4 GetContentUpdateId

Function description: Retrieves the value of content update ID of CIS on a media server.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ContentUpdateId	Output	Type_ContentUpdateId	Changes with any modification to the content object of CIS. It is used to notify an IGRS dynamic service invocation module of any change to the content object.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.5 Browse

Function description: Returns the browsed content directory object.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	Uniquely identifies the media content object.
BrowseFlag	Input	Type_BrowseFlag	Indicates the options when browsing a content directory. The legal values are: CONSTANT_CONTAINERSELFINFO – indicates the attribute of a specified content object to be returned as a result; CONSTANT_CONTAINERCHILDREN INFO – indicates the children item attribute of the specified content object to be returned as a result.
BrowseRule	Input	Type_FilterRule	Indicates the browsing rule for a media content object in the current directory. This rule applies only to media content not to the directory.
Offset	Input	Type_Count	Indicates the offset value between the initial browsed item to the first item. The value starts from 0.
RequestCount	Input	Type_Count	Indicates the available number of objects returned that comply with the searching rule. "-1" means the number of all objects that comply with the searching condition.
SortRule	Input	Type_SortRule	Indicates the sorting rule of the media content object to be browsed. See the data type definition of Type_SortRule.
ResultScale	Input	Type_AttributeList	Optional. Determines the content scale of the result. If the parameter does not exist, all available metadata attributes shall be returned in the content list for the object. If the parameter exists, metadata attributes specified in this structure should be returned in the content list for the object and other metadata attributes not specified shall not be returned.
Result	Output	Type_ContentList	Media object result list.
NumberReturned	Output	Type_Count	Indicates the number of media content objects returned as a browsing result.
ContainerNumberTotal	Output	Type_Count	Optional. Indicates the number of sub-containers under the media content object.
ItemNumberTotal	Output	Type_Count	Optional. Indicates the number of sub-items that comply with the browsing rule under the media content object.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.1.6).

8.1.5.6 Search

Function description: Specifies the content object to be searched with specific search conditions. This means searching all item information in the specified content directory (including a recursive search of the item information in the sub-directory).

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	Uniquely identifies the media content object.
SearchRule	Input	Type_FilterRule	Indicates the search rule for searching the media content object. See the definition of the data type Type_FilterRule.
Offset	Input	Type_Count	Indicates the offset value between the initial searched item to the first item. The value starts from 0.
RequestCount	Input	Type_Count	Indicates the available number of objects returned that comply with the searching rule. "-1" means the number of all objects that comply with the searching condition.
SortRule	Input	Type_SortRule	Indicates the sorting rule of the media content object to be browsed. See the data type definition of Type_SortRule.
Result	Output	Type_ContentList	Media object result list.
NumberReturned	Output	Type_Count	Indicates the number of media content objects returned as searching result.
NumberTotalMatched	Output	Type_Count	Optional. Indicates the total number of media content objects that comply with the searching condition.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.1.6).

8.1.5.7 GetAttributeList

Function description: Allows the IGRS dynamic service invocation module to retrieve a list of the metadata attributes supported by the content object on CIS.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	Uniquely identifies the media content object.
AttributeList	Output	Type_AttributeList	Media item attribute list supported by the media content object.
NumberReturned	Output	Type_Count	Indicates the number of attribute objects in the search result.

Return Value: Success: 0

Failure: E1, E2, E3, E5 (see error codes in 8.1.6).

8.1.5.8 SearchAttributeValue

Function description: Allows the IGRS dynamic service invocation module to search for a media item attribute value set by the media item attribute name. The searching capability of the media item attribute value can be retrieved by invoking the GetAttributeValueSearchCapabilityList() interface of the CIS.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	Uniquely identifies the media content object (only applicable to container object).
SearchAttributeName	Input	Type_SearchAttributeName	Indicates the name of a media item attribute to be searched, such as the attribute value of singer, genre and author, etc. of audio files.
Offset	Input	Type_Count	Indicates the offset value between the initial searched attribute value to the first attribute value. The value starts from 0.
RequestCount	Input	Type_Count	Indicates the number of attribute value to be searched.
AttributeValueList	Output	Type_AttributeValueList	Media item attribute value list. For example, if search with the singer condition, the return value is the singers' list under the specified directory.
NumberReturned	Output	Type_Count	Indicates the number of attribute objects in the search result.
NumberTotalMatched	Output	Type_Count	Optional. Indicates the total number of attribute objects that comply with the search condition.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.1.6).

8.1.5.9 ConvertMediaFormat

Function description: Converts media content format. The IGRS dynamic service invocation module sends requests to the CIS to investigate whether the media content format can be converted. If the media content format can be converted before media transport takes place, a successful message is returned. Otherwise, a failure message is returned.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	ID of media content object to be converted.
CurrentMediaFormat	Input	Type_MediaFormat	Current format of media content.
TargetMediaFormat	Input	Type_MediaFormat	Media content object format after transcoding.

Return Value: Success: 0

Failure: E1, E2, E3, E5 (see error codes in 8.1.6).

8.1.5.10 CreateObject

Function description: Creates new content objects. The object can be a new content container or new content item.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ContainerId	Input	Type_ObjectId	Content container, such as CD playlist.
Elements	Input	Type_ContentList	Initial content of the content object to be created.
ObjectId	Output	Type_ObjectId	ID of the created content directory object.
Result	Output	Type_ContentList	Content of the created content directory object.

Return Value: Success: 0

Failure: E1, E2, E3, E5 (see error codes in 8.1.6).

8.1.5.11 DestroyObject

Function description: Deletes content objects. If the specified object is a directory, then all sub-content under this directory shall be deleted.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	ID of content object.

Return Value: Success: 0

Failure: E1, E2, E3, E5 (see error codes in 8.1.6).

8.1.5.12 UpdateObject

Function description: Modifies, deletes or inserts tag data in a content object.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	ID of content object.
CurrentTag	Input	Type_TagList	Tag data list in form of XML.
NewTag	Input	Type_TagList	Tag data list in form of XML.

Return Value: Success: 0

Failure: E1, E2, E3, E5 (see error codes in 8.1.6).

8.1.5.13 ImportResource

Function description: Imports the specified remote media URI to the specified local location of CIS.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
SourceURI	Input	Type_URI	URI of remote media resource.
DestinationURI	Input	Type_URI	URI of local media resource.
TransferInstanceId	Output	Type_TransferInstanceId	Identifies the specific media transfer.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.14 ExportResource

Function description: Exports a local media resource of the CIS to the specified remote resource location.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
SourceURI	Input	Type_URI	URI of local media resource.
DestinationURI	Input	Type_URI	URI of remote media resource.
TransferInstancelId	Output	Type_TransferInstancelId	Identifies the specific media transfer.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.15 StopTransferResource

Function description: Stops the media resource transfer triggered by the ImportResource or ExportResource.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
TransferInstancelId	Input	Type_TransferInstancelId	Identifies the specific media transfer.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.16 GetTransferInstancelIds

Function description: Retrieves transfer instance ids of the current active media transfer resource file on CIS.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
TransferInstancelIds	Output	Type_TransferInstancelIds	List of current active media transfer instance ids.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.17 GetTransferState

Function description: Whenever there is an ExportResource or ImportResource active, this interface can be invoked to get the current state of media transfer resource file.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
TransferInstanceId	Input	Type_TransferInstanceId	Identifies the specific media transfer.
TransferState	Output	Type_TransferState	Indicates the current state of media transfer. It can be: "IN_PROGRESS", "STOPPED", "COMPLETED" or "ERROR".
TransferLength	Output	Type_Length	Indicates the size of media content that have completed transferring in bytes.
TransferTotal	Output	Type_Length	Indicates the total number of media content to be transferred in bytes.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.18 DeleteResource

Function description: Deletes the media resource object identified by the ResourceURI in the content directory.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ResourceURI	Input	Type_URI	URI of the resource to be deleted.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.1.6).

8.1.5.19 PersonalizedSearch

Function description: Specifies the content object to be searched according to specific user's preferences and search conditions that include all item information in the specified content directory (including a recursive search of item information in the sub-directory).

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ObjectId	Input	Type_ObjectId	Uniquely identifies the media content object.
Users	Input	Type_UserList	Optional. Specifies the user who performs the personalized search. If this parameter is not provided, the personalised search is performed by the default user.
SearchRule	Input	Type_FilterRule	Indicates the search rule for searching media content objects. See the definition of the data type Type_FilterRule.
Offset	Input	Type_Count	Indicates the offset value between the initial searched item to the first item. The value starts from 0.
RequestCount	Input	Type_Count	Indicates the available number of objects returned that comply with the search rule. "-1" means the number of all objects that comply with the search condition.
Result	Output	Type_ContentList	The Media object result list and each media item object in the list has the rank metadata attribute (see A.2.2.2).
NumberReturned	Output	Type_Count	Indicates the number of media content objects returned as search result.
NumberTotalMatched	Output	Type_Count	Optional. Indicates the total number of media content objects that comply with the user's preference and search condition.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.1.6).

8.1.5.20 PersonalizedRecommend

Function description: Specifies the content object to be recommended in order to match the user's preference. The user's preference includes all item information in the specified content directory (including a recursive recommendation of item information in the sub-directory).

Input/Output parameter:

Parameter	Input/Output	Data Type	Field explanation
ObjectId	Input	Type_ObjectId	Uniquely identifies the media content object.
Users	Input	Type_UserList	Optional. Specifies the user to perform the personalised recommendation. If this parameter is not provided, the personalised recommendation is performed by the default user.
Offset	Input	Type_Count	Indicates the offset value between the initial searched item to the first item. The value starts from 0.
RequestCount	Input	Type_Count	Indicates the available number of objects returned that comply with the search rule. "-1" means the number of all objects that comply with the search condition.
Result	Output	Type_ContentList	The Media object result list and each media item object in the list has the Rank metadata attribute (see A.2.2.2).
NumberReturned	Output	Type_Count	Indicates the number of media content objects returned as the returned recommendation result.
NumberTotalMatched	Output	Type_Count	Optional. Indicates the total number of media content objects that comply with the user's preference.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.1.6).

8.1.6 Content index service error code definition

Error code	Error code name	Value	Field explanation
0	RETURN_SUCCESS	0	Success
E1	RETURN_FAILED	1	Failed
E2	RETURN_INVALIDPARA	2	Invalid parameter
E3	RETURN_ERRORFORMATPARA	3	Parameter format error
E4	RETURN_OFFSETOVERFLOW	4	Offset overflow
E5	RETURN_OBJECTINEXISTENCE	5	Object not exist
E6	RETURN_INTERFACEINEXISTENCE	14	Interface not exist

8.2 Connection management service

8.2.1 Overview

Connection Management Service is used to create and manage the connection between a media server and media client (also refer to ISO/IEC 29341-3-1:2008). A Media server and media client can support and manage several active connections at any time by CMS.

8.2.2 Connection management service type

Connection Management Service Type is defined as:

urn:IGRS:Service:ServiceType:ConnectionManagement:1.

8.2.3 Reference flow of connection management service interface invocation

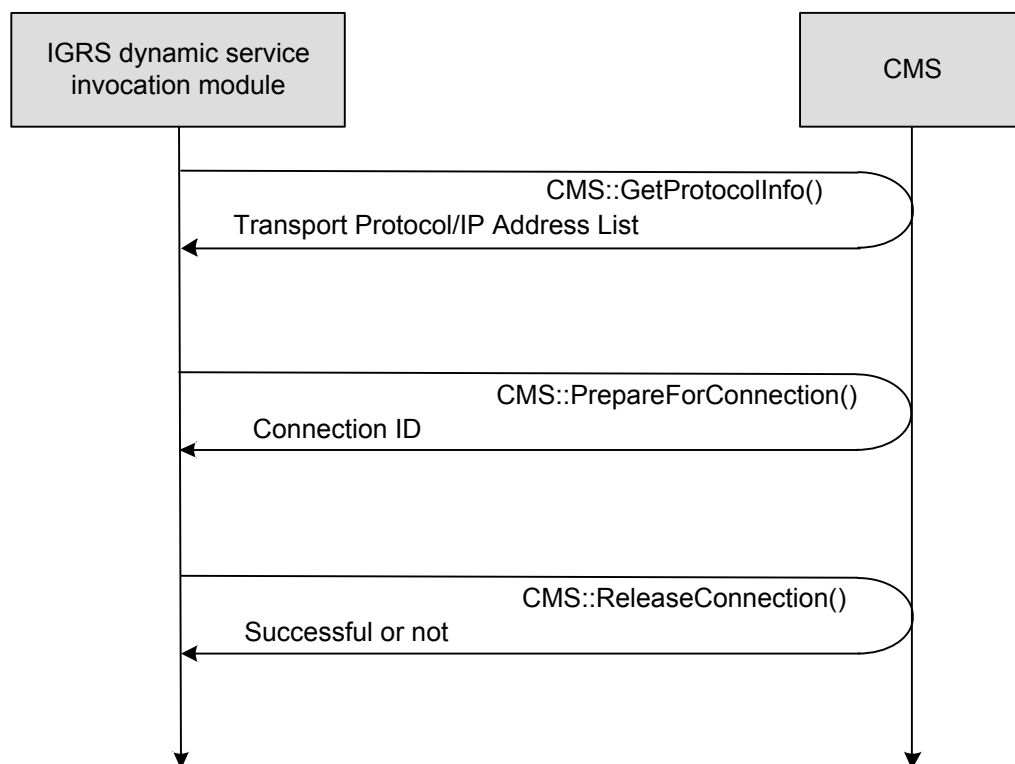


Figure 1 – Connection establishment and release flow

The process flow shown in Figure 1 is described as follows.

- By the IGRS service discovery mechanism, the IGRS dynamic service invocation module discovers the CMS.
- Get transport protocol, transport control mechanism and media format: Invoke `CMS::GetProtocolInfo()` interface of a CMS to obtain transport protocol, transport control mechanism and media format provided by the CMS and available IP address list.
- Close the connection. When the session is ended, the IGRS dynamic service invocation module invokes `CMS::ReleaseConnection()` interface of CMS to close the connection.

8.2.4 Connection management service attribute

The Service Attribute of Connection Management Service is shown in Table 4.

Table 4 – Service attribute of connection management service

Name of service attribute	Data type	Field explanation
ConnectionIdList	Type_ConnectionIdList	Current active connection ID list of current device.
ProtocolInfoList	Type_ProtocolInfoList	Media transport protocol, transport control mechanism list supported by the current device.
MediaFormatList	Type_MediaFormatList	Media format list supported by the current device.
IPList	Type_IPList	Available IP address list of the current device.

Subscription and notification of any updates of the service attribute of the Connection Management Service shall follow the general service attribute subscription and notification rules specified in ISO/IEC 14543-5-1.

8.2.5 Connection management service data type

The Data Type of Connection Management Service is shown in Table 5.

Table 5 – Data type of connection management service

Data type name	Data type	Field explanation
Type_ProtocolInfoList	XML Schema struct	Includes the media ProtocolInfo list supported by the current device.
Type_ProtocolInfo	XML Schema struct	Transport protocol, the transport control mechanism information supported by CMS. The specific definition of Type_ProtocolInfo is found in Clause C.8.
Type_ConnectionManagementServiceId	String	Connection management service ID. Its format is DeviceId/ServiceId.
Type_ConnectionId	Int	Connection ID.
Type_TransportInstanceId	Int	Media server (client) transport management service instance ID.
Type_ConnectionIdList	string list	Current active connection ID list.
Type_ConnectionState	String	Current state of connection. Its value can be: "OK", "DISCONNECTED", "CONTENTFORMATMISMATCH", "INSUFFICIENTBANDWIDTH", "UNRELIABLECHANNEL", "UNKNOWN".
Type_MediaFormatList	XML Schema struct	Media format list. See specific definition of Type_MediaFormatList in Clause C.9.
Type_IPList	XML Schema struct	Available IP address list.
Type_RenderingManagementInstanceId	Int	ID of rendering management service instance.
Type_ConnectionRoleFlag	String	Used to identify the service is for MS or MC. It is an enumeration type. Its value can be ASSERVER-for MS, ASCLIENT-for MC.

8.2.6 Connection management service invocation interface set

8.2.6.1 GetProtocolInfo

Function description: Gets the protocol information supported by the current device, including transport protocol, transport control mechanism, network port, media format and available IP address list on a MS or MC.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ProtocolInfoList	Output	Type_ProtocolInfoList	The Protocol information list supported by the current device.
MediaFormatList	Output	Type_MediaFormatList	Output media format list supported by current device.
IPList	Output	Type_IPList	Optional. Available IP address list of current device.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.2.7).

8.2.6.2 PrepareForConnection

Function description: Gets the ConnectionId that is used to prepare and instantiate media data for sending and receiving the TransportInstancelId that is used for media transport.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
RemoteProtocolInfo	Input	Type_ProtocolInfo	Indicates the transport protocol, transport control mechanism and media format for media transport.
PeerCMSId	Input	Type_ConnectionManagementServiceId	Optional. Indicates the active CMS on the peer device. Its format is DeviceId/ServiceId. A null string means the value is unknown.
PeerConnectionId	Input	Type_ConnectionId	Optional. Indicates the connection ID managed by CMS on the peer device. A "-1" means the value is unknown.
ConnectionRoleFlag	Input	Type_ConnectionRoleFlag	Used to identify the interface that is used on MS or MC. Its value can be ASSERVER or ASCLIENT.
PeerIPList	Input	Type_IPList	Optional. Available IP address list on the peer device.
ConnectionId	Output	Type_ConnectionId	ID of connection that is managed and controlled by CMS of current device.
TransportInstancelId	Output	Type_TransportInstancelId	Optional. ID of media transport managed and controlled by current device.
RmsId	Output	Type_RenderingManagementIntancelId	Optional. Output the parameter when parameter ConnectionRoleFlag is ASCLIENT. Indicates the ID used to manage and to control the media rendering service on MC.
UsableIPList	Output	Type_IPList	Optional. Open IP address returned to the IGRS dynamic service invocation module by the current device based on the input available IP address list on the peer device.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.2.7).

8.2.6.3 ReleaseConnection

Function description: Notifies a device to disconnect the connection corresponding to ConnectionId and release resource.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ConnectionId	Input	Type_ConnectionId	ID of connection that is managed and controlled by CMS of current device.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.2.7).

8.2.6.4 GetActiveConnectionIdList

Function description: Gets the current active connection ID list on MS or MC.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ConnectionIdList	Output	Type_ConnectionIdList	ID list of current active connections on current device.

Return Value: Success: 0

Failure: E1, E2, E3 (see error codes in 8.2.7).

8.2.6.5 GetCurrentConnectionInfo

Function description: Gets connection information on a media server or media client corresponding to connection ID.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
ConnectionId	Input	Type_ConnectionId	ID of connection of current device.
TransportInstanceld	Output	Type_TransportInstanceld	Optional. ID that the current device is used to manage the media transport. "-1" means the value does not exist or is unknown.
ProtocolInfo	Output	Type_ProtocolInfo	Indicates the transport protocol, transport control mechanism and media format used by the media transport.
PeerCMSId	Output	Type_ConnectionManagementServiceId	Indicates the active CMS on the peer device. A null string means the value is unknown.
PeerConnectionId	Output	Type_ConnectionId	ID of connection that is managed by CMS of a peer device. "-1" means the value is unknown.
ConnectionState	Output	Type_ConnectionState	Current state of the connection.
RmsId	Output	Type_RenderingManagementInstanceld	Optional. ID used to manage the media rendering management service on MC.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5 (see error codes in 8.2.7).

8.2.7 Content management service error code definition

Error code	Error code name	Value	Field explanation
0	RETURN_SUCCESS	0	Success
E1	RETURN_FAILED	1	Failed
E2	RETURN_INVALIDPARA	2	Invalid parameter
E3	RETURN_ERRORFORMATPARA	3	Parameter format error
E4	RETURN_CONNECTIONDISABLED	4	Disabled connection
E5	RETURN_INVALIDCONNECTIONID	5	Invalid connection ID
E6	RETURN_INTERFACEINEXISTENCE	14	Interface not exist

8.3 Media server transport management service

8.3.1 Overview

The optional Media Server Transport Management Service enables the IGRS dynamic service invocation module to adjust and to control the media stream transport on a media server, such as play, pause, stop, seek, etc. If this service exists, it means that the media server initiated transport mode is supported. Otherwise, it is not supported (also refer to ISO/IEC 29341-3-1:2008).

8.3.2 Media server transport management service type

Media Server Transport Management Service Type is defined as:

urn:IGRS:Service:ServiceType:MediaServerTransportManagement:1.

8.3.3 Reference flow of media server transport management service interface invocation

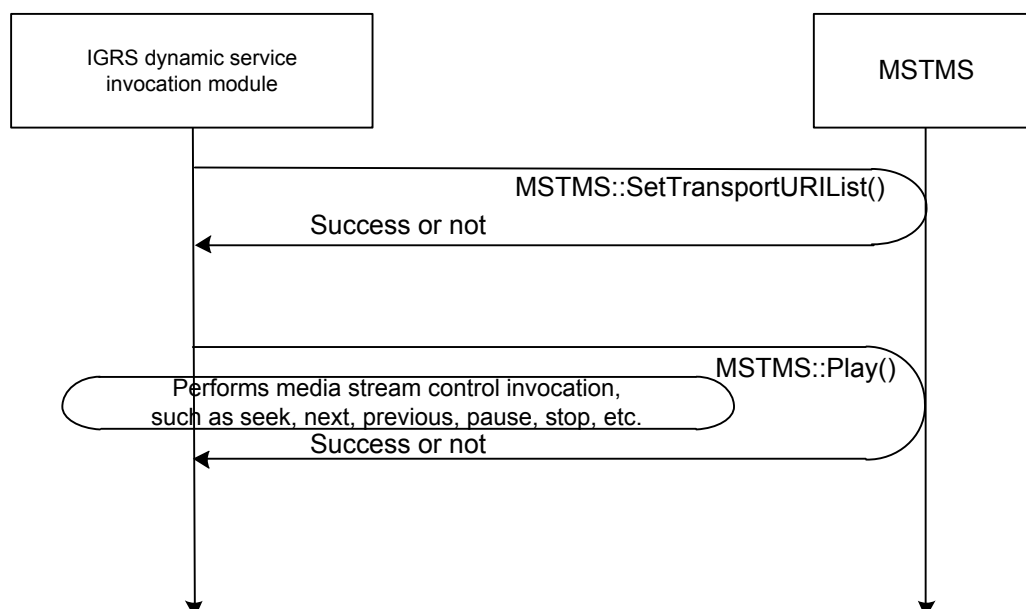


Figure 2 – Transport control flow

Flow process shown in Figure 2 is described as follows.

- By the IGRS service discovery mechanism, the IGRS dynamic service invocation module discovers the MSTMS.

- b) Select content: The IGRS dynamic service invocation module invokes the MSTMS::SetTransportURIList() to identify the content to be transported, which is located in the available IP address list returned from the MS.
- c) Initiate media transport: Use the MSTMS to invoke transport management (e.g. play, stop, seek, etc.).

8.3.4 Media server transport management service attribute

The Service Attribute of the Media Server Transport Management Service is shown in Table 6.

Table 6 – Service attribute of media server transport management service

Name of service attribute	Data type	Field explanation
TransportState	Type_TransportState	Current state of media transport.
CurrentSpeed	Type_PlaySpeed	Transport speed of current media object.
TransportURIList	Type_TransportURIList	Media source URI list transferred by MSTMS.
PlayMode	Type_PlayMode	Current media playing mode.

Subscription and notification of any updates of a service attribute of the Media Server Transport Management Service shall follow the general service attribute subscription and notification rules specified in ISO/IEC 14543-5-1.

8.3.5 Media server transport management service data type

The Data Type of Media Server Transport Management Service is shown in Table 7.

Table 7 – Data type of media server transport management service

Data type name	Data type	Field explanation
Type_TransportState	string	Current state of media transport. The values include "PLAYING", "PAUSED_PLAYBACK", "PAUSED_RECORDING", "STOPPED", "RECORDING", "TRANSITIONING", "NO_MEDIA_PRESENT", "COMPLETE", "ERROR_OCCURRED".
Type_StorageMediumName	string	Storage medium for media content. See specific definition of Type_StorageMediumName in Clause C.10.
Type_PlayMode	string	Current media playing mode. The values include "NORMAL", "SHUFFLE", "REPEAT_ONE", "REPEAT_ALL", "RANDOM", "DIRECT_1", "INTRO". "DIRECT_1" means to stop after one track has been played. "INTRO" means to play a small segment of each track, for example, 10 s.
Type_PlaySpeed	string	Specifies the speed of media transport. "NORMAL" means to play with normal speed. "FASTFORWARD" means to fast forward. "SLOWFORWARD" means to slow forward. "FASTBACKWARD" means to fast backward. "SLOWBACKWARD" means to slow backward.
Type_MediaTimeLength	string	Current media playing time specified by MSTMS instance.
Type_TransportURIList	XML Schema struct	Transport URI list of several media content objects to be transported by MSTMS instance.
Type_TransportURI	string	Transport URI of the media content object to be transported by MSTMS instance. See specific definition of Type_TransportURI in Clause C.11.
Type_Item	XML Schema struct	A media item object with metadata attribute on CIS. See specific definition of Type_Item in Clause C.12.
Type_ItemList	XML Schema struct	A list of media item objects with a metadata attribute on CIS. See specific definition of Type_ItemList in Clause C.12.
Type_SeekMode	string	Indicates the target seek mode. It can be: "TRACK_NR" (track number), "TAPE_INDEX" (tape index), "ABS_COUNT" (absolute count), "REL_COUNT" (relative count), "ABS_TIME" (absolute time), "REL_TIME" (relative time), "FRAME".
Type_SeekTargetPosition	string	Seeks target position. Marks with unit.
Type_TransportInstanceId	int	MSTMS instance ID.
Type_Count	int	Offset address of the current playing media URI in the URI list.
Type_TimeLength	unsignedInt	Specified shift time (in second).
Type_TimeShiftSwitch	string	Turns on or off Timeshift. "OPEN": Turns on TimeShift. "CLOSE": Turns off TimeShift.
Type_SelectionId	string	Selection ID of subtitle or audio track.

8.3.6 Media server transport management service invocation interface set

8.3.6.1 SetTransportURIList

Function description: Sets the TransportURIList variable. Specifies the URI list of media content object to be transported by MSTMS instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceID	Input	Type_TransportInstanceID	MSTMS instance ID.
TransportURI List	Input	Type_TransportURIList	The Transport URI list of multiple media content objects to be transported by the MSTMS instance.
ItemList	Input	Type_ItemList	Optional. IGRS dynamic service invocation module gets the media item information via Browse() or Search().

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.3.7).

8.3.6.2 GetTransportInfo

Function description: Returns the current transport state information of the transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceID	Input	Type_TransportInstanceID	MSTMS instance ID.
CurrentTransportState	Output	Type_TransportState	Current state of media transport. The values include "PLAYING", "PAUSED_PLAYBACK", "PAUSED_RECORDING", "STOPPED", "RECORDING", "TRANSITIONING", "NO_MEDIA_PRESENT", "COMPLETE", "ERROR_OCCURRED".
CurrentSpeed	Output	Type_PlaySpeed	Current playing speed.

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.3.7).

8.3.6.3 Play

Function description: Plays the media object in a media list in sequence with the specified playing speed. (The starting point is decided by Offset.) Playing is continued until the URI list has been completely played or other interfaces have been invoked, such as stop, etc. In addition, DRM transport should be established before playing copyrighted media content. The available content should include license and encrypted media content corresponding to the playing device. The encrypted media stream should be decrypted by DRM system functionality on a MS or MC.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceID	Input	Type_TransportInstanceID	MSTMS instance ID.
Offset	Input	Type_Count	The Offset address of the current playing media URI in the URI list. "-1" means the parameter is disabled.
Speed	Input	Type_PlaySpeed	Specified media playing speed.

Return Value: Success: 0

Failure: E1, E2, E3, E4, E5, E6 (see error codes in 8.3.7).

8.3.6.4 Next

Function description: Sets the the next media object in the media list to be played. The selection mode is decided by the current media-playing mode.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.3.7).

8.3.6.5 Previous

Function description: Sets the current media object as the previously played media object.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.3.7).

8.3.6.6 Stop

Function description: Stops the current media object played by the MSTMS. The current position should be reset in some devices.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.7 Pause

Function description: Pauses the current transport of the media content by the MSTMS. The current transport position remains unchanged. If the MS is the source of a broadcast, then the media stream should be saved in a buffer when paused.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.8 Resume

Function description: Resumes to transport paused media content by the MSTMS instance from the current position.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceID	Input	Type_TransportInstanceID	MSTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.9 Seek

Function description: Finds the target position specified by the input parameter in accordance with the input parameter Unit.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceID	Input	Type_TransportInstanceID	MSTMS instance ID.
Unit	Input	Type_SeekMode	Indicates the target seek mode. It can be: "TRACK_NR" (track number), "TAPE_INDEX" (tape index), "ABS_COUNT" (absolute count), "REL_COUNT" (relative count), "ABS_TIME" (absolute time), "REL_TIME" (relative time), "FRAME".
Target	Input	Type_SeekTargetPosition	Seeks the target position. Marks by above unit.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.10 TimeShift

Function description: When the media source is a broadcast program, the user can pause (save broadcast program in a cache and stop the current screen) or repeat (repeat program from the cache) the broadcast program at any moment with TimeShift mode on.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceID	Input	Type_TransportInstanceID	MSTMS instance ID.
ShiftTime	Input	Type_TimeLength	Specifies the shift time (in second).
TimeShiftSwitch	Input	Type_TimeShiftSwitch	Turns on or off TimeShift. "OPEN": Turns on TimeShift. "CLOSE": Turns off TimeShift.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.11 GetPlayURIList

Function description: Gets the URI list transported by the specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceID	Input	Type_TransportInstanceID	MSTMS instance ID.
TransportURIList	Output	Type_TransportURIList	URI list transported by MSTMS.

Return Value: Success: 0

Failed: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.12 GetAllMediaInfo

Function description: Gets the detailed content information of the media URI list transported by a specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.
ItemList	Output	Type_ItemList	All the transport media URI information in TransportURLList.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.13 GetCurrentMediaInfo

Function description: Gets the media information transported by the specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.
ElapsedDuration	Output	Type_MediaTimeLength	The Time length for which the MSTMS instance has been played.
CurrentURI	Output	Type_TransportURI	The Media content URI transported and controlled by MSTMS.
Item	Output	Type_Item	The IGRS dynamic service invocation module gets the media item information via Browse() or Search().

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.3.7).

8.3.6.14 GetPlayMode

Function description: Gets the URI playing mode controlled by the specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.
PlayMode	Output	Type_PlayMode	Current media playing mode (such as random, repeat, etc.).

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.15 SetPlayMode

Function description: Sets the playing mode.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.
NewMode	Input	Type_PlayMode	Sets media playing mode (such as random, repeat etc.).

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.16 SelectSubtitle

Function description: Sets the subtitle to be used for media playing.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.
SelectionId	Input	Type_SelectionId	Specific selection value.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.6.17 SelectAudioTrack

Function description: Sets the audio track to be used for media playing.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MSTMS instance ID.
SelectionId	Input	Type_SelectionId	Specific selection value.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.3.7).

8.3.7 Media server transport management service error code definition

Error code	Error code name	Value	Field explanation
0	RETURN_SUCCESS	0	Success
E1	RETURN_FAILED	1	Failed
E2	RETURN_INVALIDPARA	2	Invalid parameter
E3	RETURN_ERRORFORMATPARA	3	Parameter format error
E4	RETURN_OFFSETOVERFLOW	4	Offset overflow
E5	RETURN_OBJECTINEXISTENCE	5	Object not exist
E6	RETURN_CONNECTIONDISABLED	6	Connection disabled
E7	RETURN_INTERFACEINEXISTENCE	14	Interface not exist

8.4 Media client transport management service

8.4.1 Overview

The optional Media Client Transport Management Service enables the IGRS dynamic service invocation module to adjust and to control the transport of a media stream on a media client such as play, pause, stop, seek, etc. If this service exists, it means that the media client initiated

transport mode is supported. Otherwise, it is not supported (also refer to ISO/IEC 29341-3-1:2008).

8.4.2 Media client transport management service type

The Media Client Transport Management Service Type is defined as:

urn:IGRS:Service:ServiceType:MediaClientTransportManagement:1.

8.4.3 Reference flow of media client transport management service interface invocation

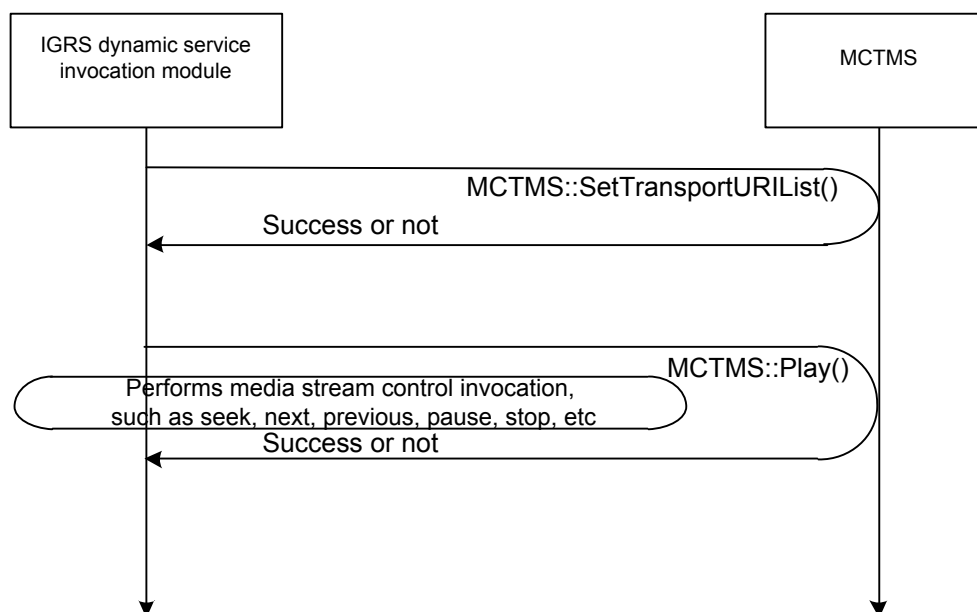


Figure 3 – Transport control flow

The Flow Process shown in Figure 3 is described as follows.

- By the IGRS service discovery mechanism, the IGRS dynamic service invocation module discovers the MCTMS.
- Select content: the IGRS dynamic service invocation module invokes the MCTMS::SetTransportURIList() to identify the content to be transported.
- Initiate media transport: Use the MCTMS to invoke transport management (e.g. play, stop, seek, etc.).

8.4.4 Media client transport management service attribute

The Service Attribute of Media Client Transport Management Service is shown in Table 8.

Table 8 – Service attribute of media client transport management service

Name of service attribute	Data type	Field explanation
TransportState	Type_TransportState	Current state of media transport and service.
CurrentSpeed	Type_PlaySpeed	Transport speed of current media object.
TransportURIList	Type_TransportURIList	The Media source URI list transferred by MCTMS.
PlayMode	Type_PlayMode	Current media playing mode.

Subscription and notification of any updates of service attribute of Media Client Transport Management Service shall follow the general service attribute subscription and notification rules specified in ISO/IEC 14543-5-1.

8.4.5 Media client transport management service data type

The Data Type of Media Client Transport Management Service is shown in Table 9.

Table 9 – Data type of media client transport management service

Data type name	Data type	Field explanation
Type_TransportState	string	Current state of media transport. The values include "PLAYING", "PAUSED_PLAYBACK", "PAUSED_RECORDING", "STOPPED", "RECORDING", "TRANSITIONING", "NO_MEDIA_PRESENT", "COMPLETE", "ERROR_OCCURRED".
Type_StorageMediumName	string	Storage medium for media content. See specific definition of Type_StorageMediumName in Clause C.10.
Type_PlayMode	string	Current media playing mode, including "NORMAL", "SHUFFLE", "REPEAT_ONE", "REPEAT_ALL", "RANDOM", "DIRECT_1", "INTRO". "DIRECT_1" means to stop after one track has been played. "INTRO" means to play a small segment of each track, for example, 10 s.
Type_PlaySpeed	string	Specifies the speed of media transport. "NORMAL" means to play with normal speed. "FASTFORWARD" means to fast forward. "SLOWFORWARD" means to slow forward. "FASTBACKWARD" means to fast backward. "SLOWBACKWARD" means to slow backward.
Type_MediaTimeLength	string	Current media playing time specified by MCTMS instance.
Type_TransportURIList	string	Transport URI list of several media content objects to be transported by MCTMS instance.
Type_TransportURI	string	Transport URI of the media content object to be transported by MCTMS instance. See specific definition of Type_TransportURI in Clause C.11.
Type_Item	XML Schema struct	Metadata attribute of media item object on CIS. See specific definition of Type_Item in Clause C.12.
Type_ItemList	XML Schema struct	A list of metadata attribute of media item objects on CIS. See specific definition of Type_ItemList in Clause C.12.
Type_SeekMode	string	Indicates the target seek mode. It can be: "TRACK_NR" (track number), "TAPE_INDEX" (tape index), "ABS_COUNT" (absolute count), "REL_COUNT" (relative count), "ABS_TIME" (absolute time), "REL_TIME" (relative time), "FRAME".
Type_SeekTargetPosition	string	Seeks target position. Marks with unit.
Type_TransportInstanceId	int	MCTMS instance ID.
Type_Count	int	Offset address of the current playing media URI in the URI list.
Type_RecordInput	string	Indicates whether a specified media source being recorded comes from an analog or digital source. It can be either "DIGITAL" or "ANALOG".
Type_RecordBitRateType	string	Indicates whether a specified encoder uses a variable bit rate or fixed bit rate when recording. Applicable only for an analog source. It can be either "FIXED" or "VARIABLE".
Type_RecordBitRate	unsignedInt	Optional. When recording, if the specified encoder is of fixed bit rate type, then this parameter is the fixed bit rate. If the specified encoder is of variable bit rate type, then it is the average bit rate. Applicable only to analog sources.
Type_RecordAudioSampleRate	unsignedInt	Audio sample rate. Applicable only to analog sources.
Type_RecordAudioBitRate	unsignedInt	Audio code bit rate. Applicable only to analog sources.
Type_RecordVideoFormat	string	Indicates the format of a media source when recording.
Type_TimeLength	unsignedInt	Specified shift time (in second).
Type_TimeShiftSwitch	string	Turns on or off TimeShift. "OPEN": Turns on TimeShift. "CLOSE": Turns off TimeShift.
Type_SelectionId	string	Selection ID of subtitle or audio track.

8.4.6 Media client transport management service invocation interface set

8.4.6.1 SetTransportURIList

Function description: Sets the TransportURIList variable. Specifies the URI list of media content object to be transport by the MCTMS instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
TransportURIList	Input	Type_TransportURIList	The Transport URI list of multiple media content objects to be transported by MCTMS instance.
ItemList	Input	Type_ItemList	Optional. The IGRS dynamic service invocation module gets media item information via Browse() or Search().

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.2 GetTransportInfo

Function description: Gets the current transport state information of a transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
CurrentTransportState	Output	Type_TransportState	Current state of media transport. The values include "PLAYING", "PAUSED_PLAYBACK", "PAUSED_RECORDING", "STOPPED", "RECORDING", "TRANSITIONING", "NO_MEDIA_PRESENT", "COMPLETE", "ERROR_OCCURRED".
CurrentSpeed	Output	Type_PlaySpeed	Current playing speed.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.3 Play

Function description: Plays a media object in a media list with a specified playing speed. The starting point is decided by Offset. Playing is continued until the URI list has been completely played or other interfaces have been invoked, such as stop, etc. In addition, DRM transport should be established before playing copyrighted media content. The available content should include license and encrypted media content corresponding to the playing device. The encrypted media stream should be decrypted by DRM system tool on an MS or MC.

To implement this interface for RTSP/RTP out-of-band transport, the RTSP client within the media client should send a RTSP SETUP request to the RTSP server within the media server to initialise the RTSP session between the media client and the media server, and then send a RTSP PLAY request to the RTSP server to play the content. If the previously playing media is a

RTSP/RTP stream and is still active, the RTSP client should send a RTSP TEARDOWN request to stop the RTSP session first. When the RTSP client finishes playing the current media, it should send a RTSP TEARDOWN request to stop the RTSP session.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
Offset	Input	Type_Count	Offset address of the current playing media URI in the URI list. "-1" means the parameter is disabled.
Speed	Input	Type_PlaySpeed	Specified media playing speed.

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.4.7).

8.4.6.4 Next

Function description: Sets the next media object in the media list to be played. The selection mode is decided by the current media playing mode.

To implement this interface for an RTSP/RTP out-of-band transport, the RTSP client within a media client should send an RTSP SETUP request to the RTSP server within the media server to initialise the RTSP session between the media client and media server, and then send an RTSP PLAY request to an RTSP server to play the content. If the previously playing media is an RTSP/RTP stream and is still active, the RTSP client should send an RTSP TEARDOWN request to stop the RTSP session first. When the RTSP client finishes playing the current media, it should send an RTSP TEARDOWN request to stop the RTSP session.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.4.7).

8.4.6.5 Previous

Function description: Sets the current media object as the previously played media object.

To implement this interface for an RTSP/RTP out-of-band transport, the RTSP client within media client should send an RTSP SETUP request to the RTSP server within the media server to initialise the RTSP session between the media client and media server, and then send an RTSP PLAY request to RTSP server to play the content. If the previously playing media is an RTSP/RTP stream and is still active, the RTSP client should send an RTSP TEARDOWN request to stop the RTSP session first. When the RTSP client finishes playing the current media, it should send a RTSP TEARDOWN request to stop the RTSP session.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.4.7).

8.4.6.6 Stop

Function description: Stops the current media object played by the MCTMS. The current position should be reset in some devices.

To implement this interface for an RTSP/RTP out-of-band transport, the RTSP client within media client should send an RTSP TEARDOWN request to stop the RTSP session.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
Instanceld	Input	Type_TransportInstanceld	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.7 Pause

Function description: Pauses the current transport of media content by MCTMS. Current transport position remains unchanged. If the MS is the source of broadcast, then the media stream should be saved in a buffer when paused.

To implement this interface for an RTSP/RTP out-of-band transport, the RTSP client within media client should send an RTSP PAUSE request to pause the RTSP session.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
Instanceld	Input	Type_TransportInstanceld	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.8 Resume

Function description: Resumes to transport paused media content by the MCTMS instance from the current position.

To implement this interface for an RTSP/RTP out-of-band transport, the RTSP client within media client should send an RTSP PLAY request to resume the RTSP session.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
Instanceld	Input	Type_TransportInstanceld	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.9 Seek

Function description: Finds the target position specified by the input parameter in accordance with the input parameter Unit.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
Unit	Input	Type_SeekMode	Indicates the target seek mode. It can be: "TRACK_NR" (track number), "TAPE_INDEX" (tape index), "ABS_COUNT" (absolute count), "REL_COUNT" (relative count), "ABS_TIME" (absolute time), "REL_TIME" (relative time), "FRAME".
Target	Input	Type_SeekTargetPosition	Seeks the target position. Marks by above unit.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.10 TimeShift

Function description: When the media source is a broadcast program, the user can pause (save broadcast program in cache and stop the current screen) or repeat (repeat program from cache) the broadcast program at any moment with TimeShift mode on.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
ShiftTime	Input	Type_TimeLength	Specifies the shift time (in second).
TimeShiftSwitch	Input	Type_TimeShiftSwitch	Turns on or off TimeShift. "OPEN": Turns on TimeShift. "CLOSE": Turns off TimeShift.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.11 GetPlayURIList

Function description: Gets the URI list transported by a specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
TransportURIList	Output	Type_TransportURIList	The URI list of media content objects transported by MCTMS.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.12 GetAllMediaInfo

Function description: Gets the detailed content information of a media URI list transported by the specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
ItemList	Output	Type_ItemList	All the transport media URI information in TransportURLList.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.13 GetCurrentMediaInfo

Function description: Gets media information transported by the specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
ElapsedDuration	Output	Type_MediaTimeLength	Time length for which MCTMS instance has been played.
CurrentURI	Output	Type_TransportURI	Media content URI transported and controlled by MCTMS.
Item	Output	Type_Item	The IGRS dynamic service invocation module gets media item information via Browse() or Search().

Return Value: Success: 0

Failure: E1, E2, E3, E5, E6 (see error codes in 8.4.7).

8.4.6.14 GetPlayMode

Function description: Gets the URI playing mode controlled by the specified transport service instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
PlayMode	Output	Type_PlayMode	Current media playing mode (such as random, repeat etc.).

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.15 SetPlayMode

Function description: Sets playing mode.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
NewMode	Input	Type_PlayMode	Sets media playing mode (such as random, repeat etc.).

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.16 Record

Function description: Records in real-time the media stream on the specified media transport instance between the MC and MS.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
RecordInput	Input	Type_RecordInput	Indicates whether the specified media source being recorded is from an analog or digital source. It can be either "DIGITAL" or "ANALOG".
Type_RecordBitRateType	Input	Type_RecordBitRateType	Indicates whether a specified encoder uses variable bit rates or fixed bit rates when recording. Applicable only to an analog source. It can be either "FIXED" or "VARIABLE".
Type_RecordBitRate	Input	Type_RecordBitRate	Optional. When recording, if the specified encoder is of fixed bit rate type, then this parameter is the fixed bit rate. If the specified encoder is of variable bit rate type, then it is the average bit rate. Applicable only to analog sources.
Type_RecordAudioSampleRate	Input	Type_RecordAudioSampleRate	Optional. Audio sample rate. Applicable only to analog sources.
Type_RecordAudioBitRate	Input	Type_RecordAudioBitRate	Optional. Audio code bit rate. Applicable only to analog sources.
Type_RecordVideoFormat	Input	Type_RecordVideoFormat	Optional. Indicates the format of the media source when recording. Applicable only to analog sources.

Return Value: Success: 0

Failure: E1, E2, E3, E6, E7, E8 (see error codes in 8.4.7).

8.4.6.17 PauseRecord

Function description: Pauses media content that is being recorded by the MCTMS instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.18 ResumeRecord

Function description: Resumes to record media content managed by the MCTMS instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.19 StopRecord

Function description: Stops recording the media content by the MCTMS instance.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.20 SelectSubtitle

Function description: Sets the subtitle to be used for media playing.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
SelectionId	Input	Type_SelectionId	Specific selection value.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).

8.4.6.21 SelectAudioTrack

Function description: Sets the audio track to be used for media playing.

Input/Output parameter:

Parameter	Input/Output	Data type	Field explanation
InstanceId	Input	Type_TransportInstanceId	MCTMS instance ID.
SelectionId	Input	Type_SelectionId	Specific selection value.

Return Value: Success: 0

Failure: E1, E2, E3, E6 (see error codes in 8.4.7).