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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

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CONTENTS

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

FOREWORD

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International Standard ISO/IEC 14543-5-21 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) architecure – 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**
  - Specifies 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 5-21: Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Application profile – AV profile

1 Scope

This part of ISO/IEC 14543 specifies the media data stream service profile, the device interaction flow, the request and response message format used in device interaction and the description format of services provided by the device.

This part of ISO/IEC 14543 is applicable to computers, household appliances and communication devices that implement media data streaming 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 14543-5-6:2012, *Information technology – Home electronic system (HES) architecture –Part 5-6:— Intelligent grouping and resource sharing for HES Class 2 and Class 3 – Service type*

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

3 Terms, definitions and abbreviations

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

3.1.3
IGRS client
application that invokes the services of one or more connected IGRS devices

NOTE Multiple client instances can exist on a network simultaneously.

3.1.4
IGRS device
information device that conforms to the IGRS specification

3.1.5
IGRS dynamic service invocation module
part of the AV application logic to orchestrate the interaction of application services according 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 another separate device.

3.1.6
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.

3.1.7
IGRS specification
ISO/IEC 14543-5 series of standards

3.1.8
media client
audio/video device in an IGRS network that possesses multimedia decoding capability

NOTE Examples of media client devices 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.

3.1.9
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.

3.1.10
media server
audio/video device in IGRS network that possesses storage and computing capabilities

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

3.2 Abbreviations

AV	Audio/Video
BCM	Back Channel Message
CIS	Content Index Service
CMS	Connection Management Service
DRM	Digital Rights Management
IGRS	Intelligent Grouping and Resource Sharing
MAN	Mandatory, also refer to message definitions in ISO/IEC 14543-5-1
MC	Media Client
MCTMS	Media Client Transport Management Service
MP	Media Player
MR	Media Recorder
MS	Media Server
MSTMS	Media Server Transport Management Service
QoS	Quality of Service
RMS	Rendering Management Service
RTP	Real-time Transport Protocol
RTSP	Real-Time Streaming Protocol
SOAP	Simple Object Access Protocol
STB	Set Top Box

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 of this standard shall prevail.

4 Conformance

For conformance to this International Standard the following applies.

- The IGRS AV profile interaction model shall conform to the architecture specification contained in Clause 5.
- The relevant AV device (media server or media client) and device group (CIS device group, AV multicast device group) shall conform to the specifications contained in Clause 6.
- AV service invocation flow shall conform to the specifications described in Clause 7.
- AV invocation session setup procedure and message formats shall conform to the specifications contained in Clause 8.

5 Architecture

5.1 Overview

The IGRS AV application profile describes the composition of an IGRS AV system and an interaction model for AV devices and device groups in AV applications. An AV device may be a TV, VCR, CD/DVD player, set top box (STB), audio system, camera or digital photo frame. An AV device group is a set of devices consisting of multiple AV devices. The IGRS AV application profile supports transporting multimedia contents among IGRS AV devices using any transport protocol and any media format.

The IGRS AV system specifies a flexible architecture to support many different types of AV applications. From the perspective of the device types involved in any given application, the IGRS AV system supports a single device AV application and a device group AV application. The IGRS AV system supports a range of application types from simple AV playback to advanced personalised content management.

The IGRS AV system typically should consist of three types of devices, as shown in Figure 1: media server, media client and media device group. Correspondingly, four types of interaction models between devices in an IGRS AV application should be supported: single media server and single media client (required), multiple media servers and single media client, single media server and multiple media clients, multiple media servers and multiple media clients. 5.2 specifies each interaction model in detail.

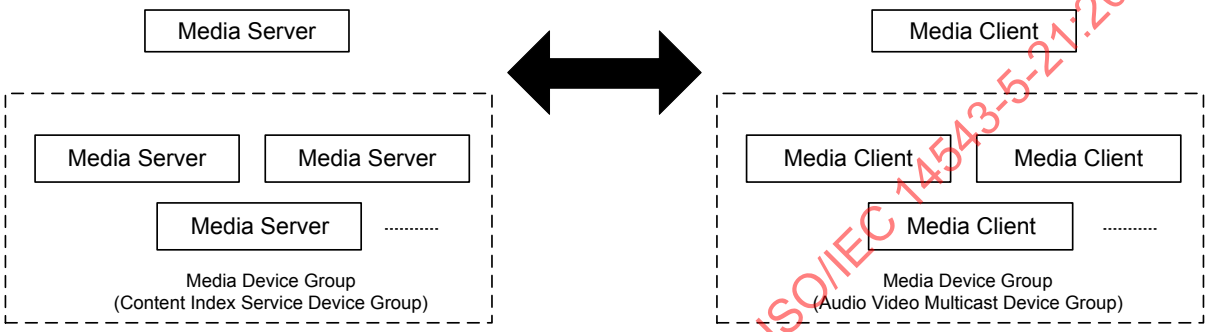

Figure 1 – Device grouping model of the IGRS AV profile

5.2 Four types of device interaction models in the IGRS AV application

5.2.1 Interaction model between a single media server and a single media client

When an IGRS AV application involves a single media server and a single media client (e.g., AV play between a media server and media client), it shall be specified by the interaction model between a single media server and a single media client (also see Clauses 4 and 5 of ISO/IEC 29341-3-1:2008), as shown in Figure 2.

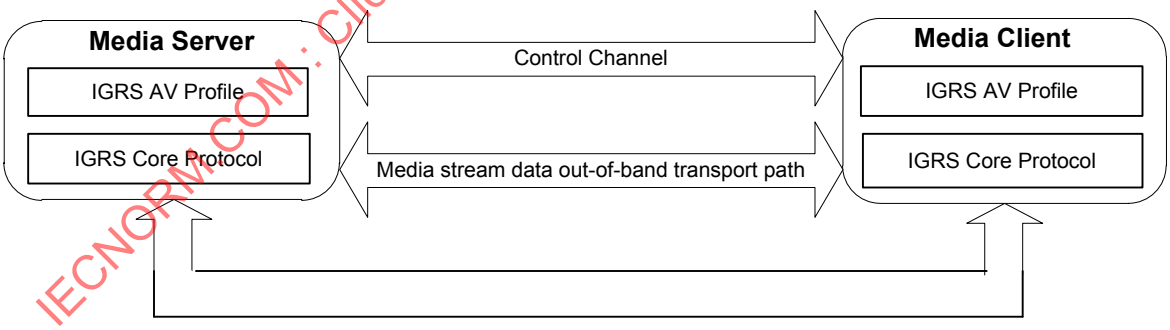

Figure 2 – Interaction model of a single media server and single media client

5.2.2 Interaction model between multiple media servers and a single media client

When an IGRS AV application involves multiple media servers and a single media client (e.g., the content is distributed in a media device group, specifically the content index service device group, consisting of multiple media servers), it should be specified by the interaction model between multiple media servers and a single media client, as shown in Figure 3.

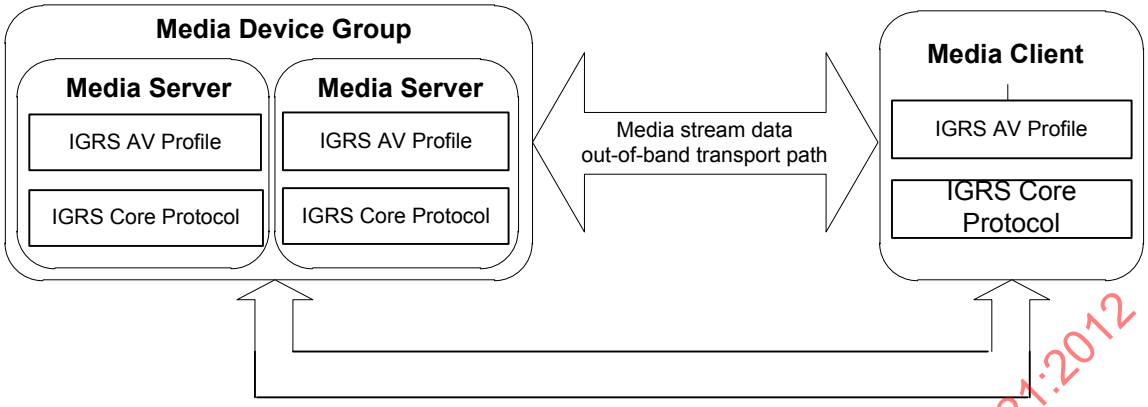

Figure 3 – Interaction model of multiple media servers and a single media client

5.2.3 Interaction model between a single media server and multiple media clients

When an IGRS AV application involves a single media server and multiple media clients (e.g., a media stream is transported from a media server to multiple media clients through multicast), it should be specified by the interaction model between a single media server and multiple media clients, as shown in Figure 4, where the media client is a member of a media device group, particularly the audio video multicast device group.

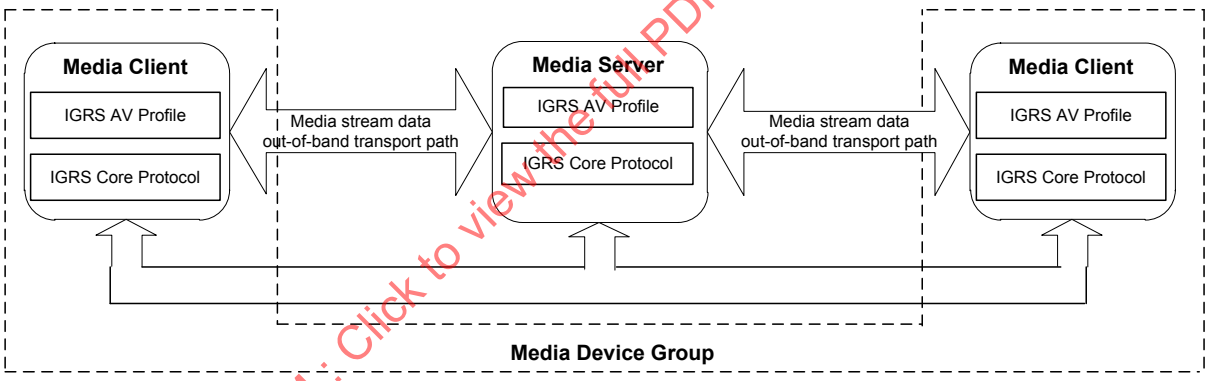

Figure 4 – Interaction model of a single media server and multiple media clients

5.2.4 Interaction model between multiple media servers and multiple media clients

When an IGRS AV application involves interactions among multiple media servers and multiple media clients, the application should be specified by the interaction model between multiple media servers and multiple media clients, as shown in Figure 5, where the media client is a member of another media device group, particularly the audio video multicast device group. An example of such an interaction consists of content that is distributed in a media device group, particularly the content index service device group, consisting of multiple media severs. The media stream is transported from the media device group consisting of multiple media servers to multiple media clients through multicast.

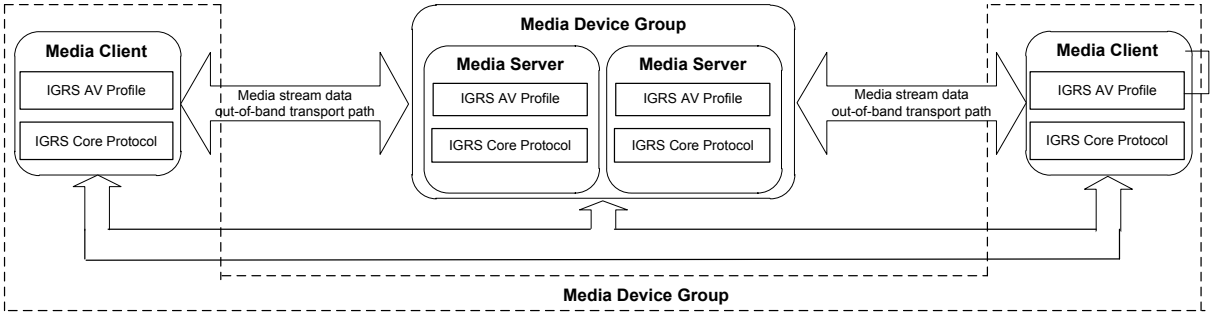

Figure 5 – Interaction model of multiple media servers and multiple media clients

6 Components of the IGRS AV system

6.1 IGRS AV applications

The IGRS AV system should support two types of AV applications: simple AV playback and advanced personalised content management. For the two types of AV applications, three different device types are specified: media server, media client and media device group. 6.2, 6.3 and 6.4 specify the composition of each device type.

6.2 Media server

6.2.1 General

In the IGRS AV system, the media server is a device with powerful computing capability and storage capacity. For example, a computer or network storage server may become a media server. In an AV application, the media server usually is used as a source device whose manageable content is provided for a media client to access and to manipulate using a standard network interface. The media server also may be used as a destination device that allows media clients to upload the content stored in other devices on the network to a media server for universal content management. The components of the IGRS media server are specified in Figure 6.

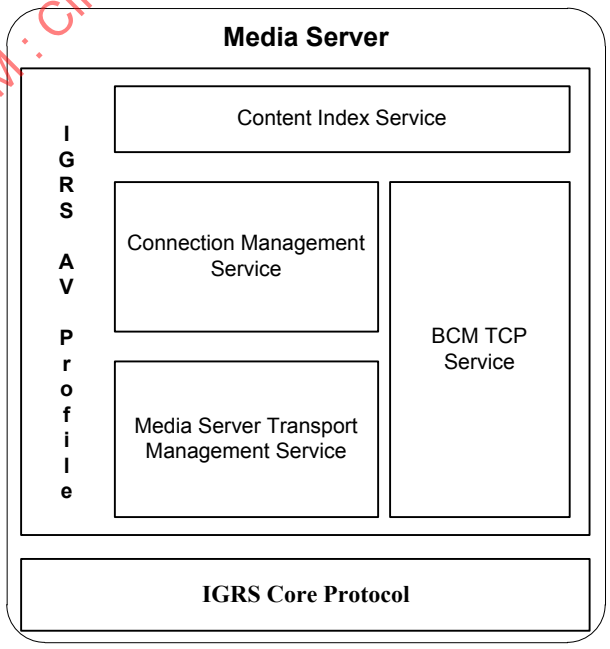

Figure 6 – Components of a media server

The components of the media server are summarised here and specified in the subsequent clauses.

– Content index service: a media server shall implement a content index service to enable a media client to browse, search and access the stored content through the interface function of the content index service.

– Connection management and transport control mechanism: a media client may select and play content on a media server. A media server shall support at least one connection management and transport control mechanism. Transport control manages the out-of-band data stream. An IGRS media server supports two types of connection management and transport control mechanisms:

  • Connection management and transport control mechanism based on BCM (Back Channel Message), specified in 6.2.3.

  • Connection management and transport control mechanism based on SOAP (Simple Object Access Protocol), specified in 6.2.4.

  A media server shall implement a BCM TCP service to support a BCM-based connection management and transport control mechanism. This allows the media server to perform both connection management and transport control on the out-of-band data stream.

  A media server shall implement the GetProtocolInfo() interface function of the connection management service to enable other devices on the network to inquire about the media format supported by a media server and retrieve the supported connection management and transport control mechanism.

  A media server may implement the connection management service and the media server transport management service using a SOAP-based connection management and transport control mechanism. BCM-based connection management and transport control are simplified access methods compared to SOAP and thus are preferred.

  A media server shall support HTTP-GET out-of-band transport data stream protocol.

  A media server should support RTSP/RTP out-of-band transport data stream protocol if multicast AV playback is implemented.

6.2.2 Content index service

The content index service specifies the content representation framework of the IGRS AV system. Through a content metadata description, the content index service provides the basic information to match media format and transport mechanism in an AV playback application between the media server and media client and also provides the necessary advanced support for a personalised content management application. The detailed specifications of the content index service are contained in 8.1 of ISO/IEC 14543-5-6.

6.2.3 BCM TCP service

The back channel message (BCM) TCP service is a type of connection management and transport control mechanism used for AV playback specified in the IGRS AV system. It is essentially a command token control protocol over the TCP protocol, including the BCM Server and BCM Client. The detailed specifications of the BCM TCP service are contained in Clause 9 of ISO/IEC 14543-5-6.

6.2.4 IGRS SOAP service

6.2.4.1 General

The connection management service takes charge of connection management between a media server and media client. The media server transport management service takes charge of the transport control of an out-of-band data stream between the media server and media client.

The IGRS AV system specifies a connection management and transport control mechanism based on BCM. The Simple Object Access Protocol (SOAP) could be used for these IGRS services. However, SOAP is not preferred because BCM is a simplified access method.

6.2.4.2 Connection management service

The connection management service specifies the interface function to enable the following functionalities:

a) inquire about the media format supported by a media server;

b) retrieve the supported connection management and transport control mechanism;

c) setup, query and release the connection between the media server and media client in IGRS AV system.

The detailed specification of CMS is contained in 8.2 of ISO/IEC 14543-5-6.

6.2.4.3 Media server transport management service

The media server transport management service specifies the interface function to control the transport of an out-of-band data stream initiated by the media server in the IGRS AV system. The detailed specification of the MSTMS is contained in 8.3 of ISO/IEC 14543-5-6.

6.3 Media client

6.3.1 General

In an IGRS network the media client is a type of device with powerful multimedia decoding capability, for example, a TV, STB or high-definition network player. In an AV application, the media client usually is a destination device that accesses and manipulates content on a media server through a standard network interface. The media client may be a source device that uploads the content stored on other devices in the network to a media server for universal content management. The components of an IGRS media client are shown in Figure 7.

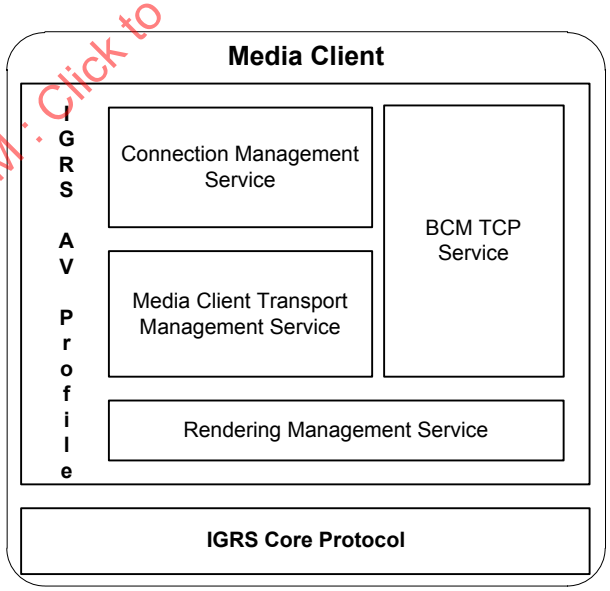

Figure 7 – Components of a media client

The IGRS media client includes two classes of devices: media player and media recorder.

After browsing and selecting the content on the media server to play and record, the media client usually sets up a connection with the media server and performs transport control of the out-of-band data stream.

The components of a media client are summarised here and specified in the subsequent clauses.

– Connection management and transport control: a media client supports two types of connection management and transport control mechanisms:

  • connection management and transport control mechanism based on BCM, specified in 6.3.2;

  • connection management and transport control mechanism based on SOAP, specified in 6.3.3.

  A media client shall support BCM-based connection management and the transport control mechanism. This allows the media client server to perform both connection management and transport control on the out-of-band data stream.

  A media client shall implement the GetProtocolInfo() interface function of the connection management service to enable other devices on the network to inquire about the media format supported by a media client and retrieve the supported connection management and transport control mechanism.

  A media client may implement the connection management service and media client transport management service using a SOAP-based connection management and transport control mechanism. BCM-based connection management and transport control are simplified access methods compared to SOAP and thus are preferred.

  A media client shall support HTTP-GET out-of-band transport data stream protocol.

  A media client should support RTSP/RTP out-of-band transport data stream protocol if multicast AV playback is implemented.

– Rendering management service: a media client should implement a rendering management service to support content rendering on playback devices, such as brightness adjustment, contrast control, volume tuning, etc.

6.3.2 BCM TCP service

The back channel message TCP service is a type of connection management and transport control mechanism used for AV playback specified in the IGRS AV system. It is essentially a command token control protocol over TCP protocol, including the BCM Server and BCM Client. The detailed specification of the BCM TCP service is contained in Clause 9 of ISO/IEC 14543-5-6.

6.3.3 IGRS SOAP service

6.3.3.1 General

The connection management service takes charge of connection management between a media server and media client. The media client transport management service takes charge of the transport control of an out-of-band data stream between the media server and media client.

The IGRS AV system specifies a connection management and transport control mechanism based on BCM. The simple object access protocol (SOAP) could be used for these IGRS services. However, SOAP is not preferred because BCM is a simplified access method.

6.3.3.2 Connection management service

The connection management service specifies the interface function to enable the following functionalities:

a) inquire about the media format supported by a media client;

b) retrieve the supported connection management and transport control mechanism;

c) setup, query and release the connection between a media server and a media client in an IGRS AV system.

The detailed specification of CMS is contained in 8.2 of ISO/IEC 14543-5-6.

6.3.3.3 Media client transport management service

The media client transport management service specifies the interface function to control the transport of an out-of-band data stream initiated by the media client in an IGRS AV system. The detailed specification of MCTMS is contained in 8.4 of ISO/IEC 14543-5-6.

6.3.4 Rendering management service

The rendering management service specifies the interface function to manage the rendering of content on a media client in an IGRS AV system. The detailed specification of RMS is contained in 8.5 of ISO/IEC 14543-5-6.

6.4 Media device group

6.4.1 Overview

An IGRS device group is a device type specified by ISO/IEC 14543-5-1 for resource sharing and device collaboration on an IGRS network. An IGRS device group shall consist of two types: a peer-to-peer device group and a centralised device group. The detailed specification is contained in 6.5 of ISO/IEC 14543-5-1.

Based on the definition of a device group in ISO/IEC 14543-5-1, the IGRS AV system specifies a special type of device group used in an IGRS AV application, namely, the media device group, which is a centralised device group consisting of a media server or a media client. The media device group includes:

– content index service device group, specified in 6.4.2.

– audio video multicast device group, specified in 6.4.3.

6.4.2 Content index service device group

The content index service (CIS) device group is a type of IGRS centralised device group consisting of multiple media servers, whose major function is to realise distributed collaboration and load balancing of the content index service instances of multiple media servers, as specified in 7.6.2. A content index service device group shall consist of a master device and multiple slave devices. All devices in the group shall support the content index service.

The master device in a CIS device group is called a CIS group master and the slave device is called a CIS group slave. CIS group master devices usually have greater computation power, bigger storage capacity and better multimedia content analysis capability and related modules. Examples of a CIS group master include a PC, notebook, storage server, etc. A CIS group master may backup the metadata of stored content on a CIS group slave and may also store actual content on a CIS group slave. CIS group slave devices usually have limited computation power and storage capacity. Examples of such devices include some embedded media devices, a digital camera, mobile phone, media adapter, etc. A device manufacturer may determine, based on the capability of a media server device, whether the device is suitable to be the master device of a CIS device group when setting up a CIS device group.

A CIS group master may obtain the content directory including all content metadata on a CIS group slave by accessing the content direcory of the CIS group slave. In general, a CIS group master should only copy the metadata on the content directory of a CIS group slave. The content should not be copied to the CIS group master. A CIS group master should index content on a CIS group slave through the ObjectURI metadata attribute, which is specified in

the content index service of ISO/IEC 14543-5-6. A CIS group master may use its content analysis module to perform simple media format analysis or advanced content scene analysis for a CIS group slave. For example, if due to limited device capabilities, a CIS group slave cannot perform facial recognition analysis accurately, a CIS group master equipped with an advanced facial recognition module should analyse the photos stored on this CIS group slave instead in order to obtain precise metadata for the content. The detailed flow process is specified in 7.6.2.

When accessing a CIS device group, a media client may obtain content directories of all devices in a CIS device group by accessing the CIS group master. However, a CIS group master usually may only copy metadata of content on a CIS group slave and may not copy content on the content directory of the slave. Therefore, a media client should set up a direct connection with the CIS group slave to access this content using an out-of-band transport protocol after obtaining the ObjectURI pointing to the content on the CIS group slave from the content directory of the CIS group master. The detailed flow process is specified in 7.6.2.

The device group type of a content index service device group shall be defined as: Centralized:av:MediaDeviceGroup:CISDeviceGroup.

6.4.3 Audio video multicast device group

An audio video multicast device group is a type of IGRS centralised device group consisting of one media server and multiple media clients. The primary application of this device group is to realise AV playback based on multicast while preserving network resource (details are specified in 7.5). An AV multicast device group is a centralised device group created by a media server (as the master device of the group) and joined by a media client as slave device.

The device group type of audio video multicast device group shall be defined as: Centralized:av:MediaDeviceGroup:AVMCastDeviceGroup.

6.5 Modular expansion of media server and media client

In an IGRS AV system, the module included in a media server and media client may be dynamically extended to support new advanced services and functionalities, besides the modules listed in 6.2 and 6.3. A media server and media client may be extended to include a DRM module, QoS module and user management module as shown in Figure 8.

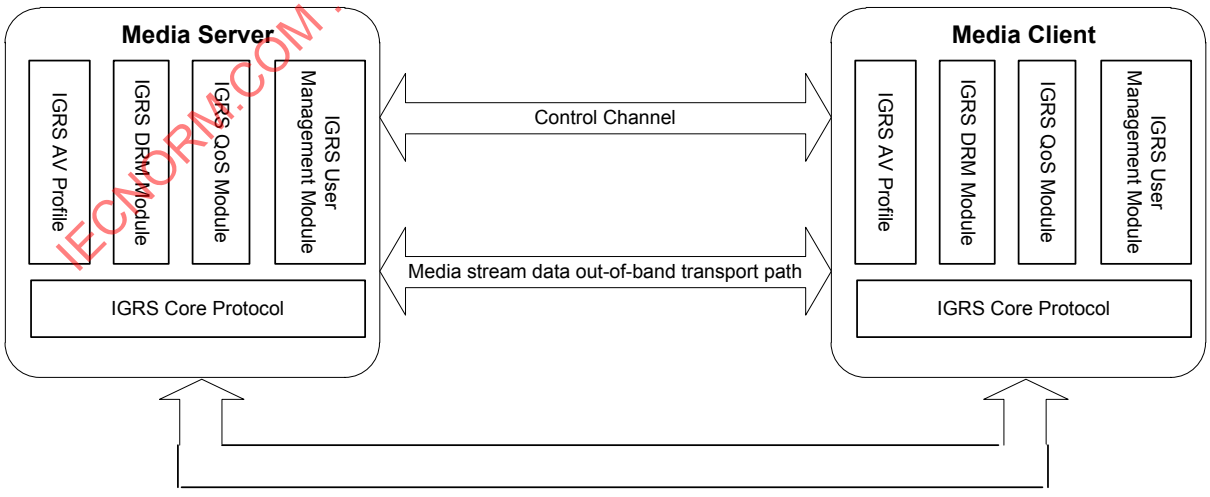

Figure 8 – Modular expansion of a media server and media client

7 Interaction flow of the IGRS AV system

7.1 Overview of interaction flow

The IGRS AV system specifies the standard interaction procedure and network interface for two types of AV applications, namely, simple AV playback and advanced personalised content management. The overall interaction flow of the IGRS AV system is depicted in Figure 9.

In the IGRS AV system interaction flow, the IGRS dynamic service invocation module shall be supported. The IGRS dynamic service invocation module may work as a part of the AV application logic to orchestrate the interaction between services with respect to the capabilities of the device or device group involved and to co-ordinate the service invocation sequence between the media server and media client. The IGRS dynamic service invocation module should be implemented on a media server, a media client or an IGRS client.

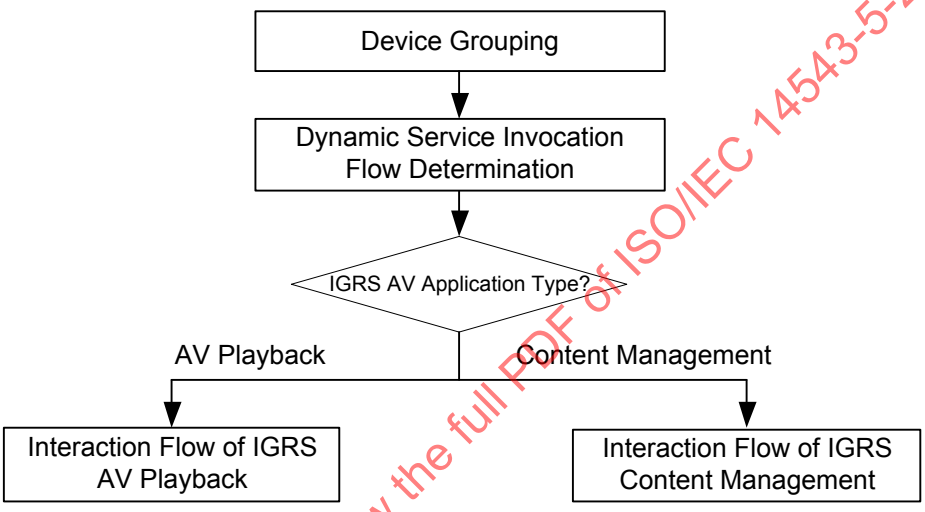

Figure 9 – Overall interaction flow of the IGRS AV system

The specific steps of the overall interaction flow of the IGRS AV system depicted in Figure 9 are specified as follows.

a) Setup device group: IGRS AV devices may setup a media device group according to the device capability match condition (7.2).

b) Determine service interaction flow: the IGRS dynamic service invocation module determines application service interaction flow according to the AV application type and matching the capabilities of the device or device group involved (7.3).

c) Select procedure: select the procedure to execute in the following steps according to the AV application type: specified in 7.4 if it is AV playback; specified in 7.6 if it is content management.

7.2 Interaction flow of device grouping

7.2.1 Overview of interaction flow of device grouping

The flow of media device group setup is specified in this subclause. The media device group is a specialised type of centralised device group specified in the ISO/IEC 14543-5-1. The setup and dismissing strategy shall obey the rules specified for a centralised device group in ISO/IEC 14543-5-1 (see 6.5, 6.14 and 9.8 in ISO/IEC 14543-5-1 for more details).

The media device group of the IGRS AV system can be divided into two classes:

– Content index service device group, which may consist of more than one media server device. This group enables distributed collaboration and load balancing among content stored and managed on several media server devices;
– Audio video multicast device group, which may consist of one media server supporting multicast function and multiple media clients, to implement the AV playback based on multicast.

The following clauses specify:

– the generic inner-group information exchange mechanism of an IGRS device group (7.2.2) and generic group management mechanism of a centralised device group (7.2.3);
– the inner-group information exchange and group management mechanism of the specific media device group (content index service device group in 7.2.4 and audio video multicast device group in 7.2.5).

7.2.2 Inner-group information exchange mechanism of IGRS device group

7.2.2.1 General

ISO/IEC 14543-5-1 has already specified the group management mechanism for an IGRS device group in detail. This subclause specifies a set of generic inner-group information exchange mechanisms among devices in a group to supplement the existing device group specification in ISO/IEC 14543-5-1.

The IGRS device group shall support two types of inner-group information exchange mechanisms. One is a notification message based on multicast, which is described in 7.2.2.2. The other is a request/response message based on unicast, which is described in 7.2.2.3.

7.2.2.2 Inner-group information exchange based on multicast notification

The inner-group information exchange based on multicast notification is a generic information exchange mechanism defined for an IGRS device group. It applies to a peer-to-peer device group as well as to a centralised device group. For any device that needs to notify other devices in the same group about the exchanged information, it shall use the notification message format specified in Table 1.

The format of exchanged information is not specified by this subclause. The only requirement is that the format of exchanged information shall be an XML element using any XML namespace convention. The inner-group exchanged information format of media device group defined in this standard is specified in 7.2.4.4 and 7.2.5.4.

Table 1 – IGRS device group inner-group information exchange notification message

Message	Field explanation
NOTIFY * HTTP/1.1	Extended HTTP COMMAND LINE
Host:239.255.255.250:3880	Required field
NT:uuid: Device Id of the Notification Source	Required field, see 8.1.2 of ISO/IEC 14543-5-1
NTS:isdp:groupalive	Required field
USN:uuid:Device Id of the Notification Source	Required field, see 8.1.2 of ISO/IEC 14543-5-1
MAN:"http://www.igrs.org/spec1.0";ns=01	Required field, see Clause B.1 of ISO/IEC 14543-5-1
01-IGRSVersion:IGRS/1.0	Required field
01-IGRSMessageType: DeviceGroupInfoExNotify	Required field
01-DeviceGroupId:Device group Id of the Notification Source	Required field, type is URI, specified in 8.1.3 of ISO/IEC 14543-5-1
01-SourceDeviceId: Device Id of the Notification Source	Required field, type is URI, specified in 8.1.2 of ISO/IEC 14543-5-1
Content-Length: message body length	Required field
Content-Type:text/xml; charset=utf-8	Required field
MAN:"http://schemas.xmlsoap.org/soap/envelope/";ns=02	Required field
02-SoapAction:"IGRS-DeviceGroup-InfoExNotify"	Required field
	Shall be empty
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">	Required field
<SOAP-ENV:Body>	Required field
<DeviceOperation xmlns="http://www.igrs.org/spec1.0">	Required field, see Clause B.1 of ISO/IEC 14543-5-1
<DeviceGroupName> device group name </DeviceGroupName>	Required field, type is string
<InfoEx> <!—Here is specific content of the exchanged information --> </InfoEx>	Required field, XML element
</DeviceOperation>	
</SOAP-ENV:Body>	Required field
</SOAP-ENV:Envelope>	Required field

7.2.2.3 Inner-group information exchange based on unicast request/response message

The inner-group information exchange based on a unicast request/response message is a generic information exchange mechanism defined for an IGRS device group. It applies to a peer-to-peer device group as well as a centralised device group. For any device that needs to receive exchanged inner-group information from other devices in the same group, it shall use the request message format specified in Table 2. The device receiving the request message shall send the expected inner-group exchanged information in the format of response message specified in Table 3.

The specific format of inner-group exchanged information is not specified by this subclause. The only requirement is that the format of information shall be an XML element using any XML namespace convention. The inner-group exchanged information format of media device group defined in this standard is specified in 7.2.4.4 and 7.2.5.4.

Table 2 – IGRS device group inner-group information exchange request message

Message	Field Explanation
M-POST /IGRS HTTP/1.1	Extend HTTP COMMAND LINE
Host: Target Host IP Address:port	Required field
MAN:"http://www.igrs.org/spec1.0";ns=01	Required field, see Clause B.1 of ISO/IEC 14543-5-1
01-IGRSVersion: IGRS/1.0	Required field, IGRS version number
01-IGRSMessageType: DeviceGroupInfoExRequest	Required field, content shall be this
01-DeviceGroupId:Device group Id	Required field, type is URI, specified in 8.1.3 of ISO/IEC 14543-5-1
01-SourceDeviceId: Device Id of request device	Required field, type is URI, specified in 8.1.2 of ISO/IEC 14543-5-1
01-TargetDeviceId: Master device Id	Required field, type is URI, specified in 8.1.2 of ISO/IEC 14543-5-1
Content-Length: message body length	Required field
Content-Type:text/xml; charset=utf-8	Required field
MAN:"http://schemas.xmlsoap.org/soap/envelope/";ns=02	Required field
02-SoapAction:"IGRS-DeviceGroup-InfoExRequest"	Required field
	Shall be empty
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">	Required field
<SOAP-ENV:Body>	Required field
<DeviceOperation xmlns="http://www.igrs.org/spec1.0">	Required field, see Clause B.1 of ISO/IEC 14543-5-1
<DeviceGroupName> device group name </DeviceGroupName>	Required field,and type is string
<SequenceId> Invocation request sequence ID </SequenceId>	Required field, type is 32 bit UnsignedInt (0 is reserved)
</DeviceOperation>	Required field
</SOAP-ENV:Body>	Required field
</SOAP-ENV:Envelope>	Required field

Table 3 – IGRS device group inner-group information exchange response message

Message	Field explanation
HTTP/1.1 200 OK	HTTP COMMAND LINE
Ext:	Required field
Cache-control:no-cache="Ext"	Required field
MAN:"http://www.igrs.org/spec1,0";ns=01	Required field, see Clause B.1 of ISO/IEC 14543-5-1
01-IGRSVersion: IGRS/1.0	Required field, IGRS version number
01-IGRSMessageType: DeviceGroupInfoExResponse	Required field, content shall be this
01-SourceDeviceId: Device Id of response device	Required field, type is URI, specified in 8.1.2 of ISO/IEC 14543-5-1
01-TargetDeviceId: Device Id of device that sent request	Required field, type is URI, specified in 8.1.2 of ISO/IEC 14543-5-1
01-DeviceGroupId: Device group Id	Required field, type is URI, specified in 8.1.3 of ISO/IEC 14543-5-1
Content-Length: Message body length	Required field
Content-Type:text/xml; charset=utf-8	Required field
MAN:"http://schemas.xmlsoap.org/soap/envelope/";ns=02	Required field
02-SoapAction:"IGRS-DeviceGroup-InfoExResponse"	Required field
	Shall be empty
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">	Required field
<SOAP-ENV:Body>	Required field
<DeviceOperation xmlns="http://www.igrs.org/spec1.0">	Required field, see Clause B.1 of ISO/IEC 14543-5-1
<DeviceGroupName> device group name </DeviceGroupName>	Required field and type is string
<AcknowledgeId> *invocation response sequence ID* </AcknowledgeId>	Required field. Type is 32 bit UnsignedInt. Same as the SequenceId in Request message.
<ReturnCode> *response status code* </ReturnCode>	Required field. See Clause 11 of ISO/IEC 14543-5-1
<InfoEx> <!—Here is specific content of the exchanged information --> </InfoEx>	Required field, XML element
</DeviceOperation>	Required field
</SOAP-ENV:Body>	Required field
</SOAP-ENV:Envelope>	Required field

7.2.3 Group management mechanism of IGRS centrialised device group

This subclause describes the generic group management mechanism of an IGRS centralised device group specified in ISO/IEC 14543-5-1.

As shown in Figure 10, the management flow of an IGRS centralised device group from the perspective of the master device is described below.

a) Create device group (centralised device group setup): a master device goes online, creates a centralised device group and sends a centralised device group online advertisement message.

b) Master device allows a slave device to join a group (join centralised device group): a slave device goes online and discovers the required IGRS centralised device group and then selects and joins a group (JoinCentralized group). The detailed strategy should be specified by the application developer and device manufacturer.

c) Master device allows a slave device to leave a group (leave centralised device group): the slave device may leave the centralised device group or goes offline directly.

d) Dismiss device group (centralised device group dismiss): master device sends the centralised device group a dismiss notification message, and the device group dissolves.

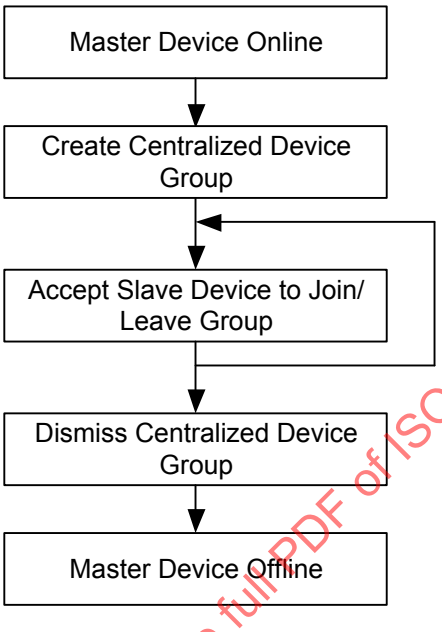

Figure 10 – Flow of centralised device group management from the perspective of a master device

As shown in Figure 11, the management flow of an IGRS centralised device group from the perspective of the slave device is described below.

e) Discover device group: a slave device goes online and discovers an IGRS centralised device group.

f) Join device group: a slave device selects and joins groups from the previously discovered IGRS centralised device groups.

g) Leave device group: a slave device may leave a centralised device group or goes offline directly.

h) Slave device goes offline.

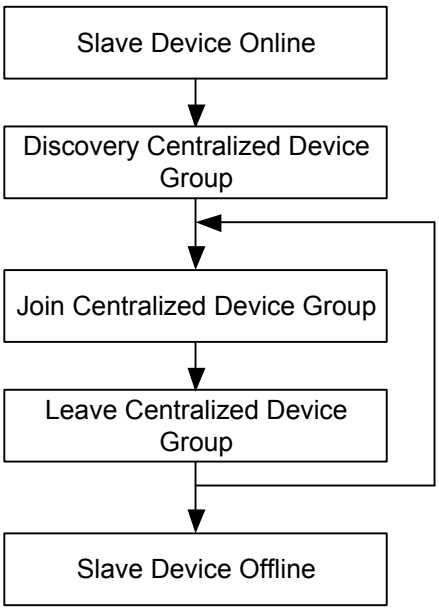

Figure 11 – Flow of centralised device group management from the perspective of slave device

7.2.4 Content index service device group

7.2.4.1 General

A CIS device group is a type of IGRS media device group. It is composed of several media servers. The master device is called a CIS group master, and the slave device is called a CIS group slave.

7.2.4.2 Group setup strategy of content index service device group

In an IGRS network, there shall be at most one content index service device group with only one media server as the master device at any time. The voting strategy of the CIS group master shall adopt the pre-emptive method, which allows only the first media-server's setup content index service device group request to be processed successfully while denying all other requests.

7.2.4.3 Content index service device group online advertisement message

The CIS group master shall send a content index service device group online advertisement message periodically (see 9.5.3.2 of ISO/IEC 14543-5-1). An XML element "DeviceGroupType" shall be added to the SOAP message body with a value that shall be: Centralized:av:MediaDeviceGroup:CISDevcieGroup, as stated in Table 4.

Table 4 – Content index service device group online advertisement message

Message	Field explanation
NOTIFY * HTTP/1.1	Extended HTTP COMMAND LINE
Host:239.255.255.250:3880	Required field
Cache-control:max-age=Max advertisement valid time	Required field, type is 32 bit unsignedInt (0 is reserved) when device receives this message and the time has expired, the device group no longer exists; before this max–age is reached, master device shall send new device group advertisement to reset this time, unit is in second
Location: http://www.igrs.org/devicegroup/centralised	Required field, see Clause B.6 of ISO/IEC 14543-5-1
NT:uuid:Advertising Device Group Id	Required field, see 8.1.3 of ISO/IEC 14543-5-1
NTS:isdp:groupalive	Required field, ISDP requirement
SERVER: OS/version IGRS/1.0 product/version	Required field
USN:uuid:Advertising Device Group Id	Required field, see 8.1.3 of ISO/IEC 14543-5-1
MAN:"http://www.igrs.org/spec1.0";ns=01	Required field, see Clause B.1 of ISO/IEC 14543-5-1
01-IGRSVersion:IGRS/1.0	Required field, IGRS version number
01-IGRSMessageType:CentralisedDeviceGroupAdvertisement	Required field, content shall be this
01-SourceDeviceId: Source Device Id that is sending group advertisement	Required field, type is URI, specified in 8.1.2 of ISO/IEC 14543-5-1
Content-Type:text/xml; charset=utf-8	Required field
Content-Length: Message body length	Required field
MAN:"http://www.w3.org/2002/12/soap-envelope";ns=02	Required field
02-SoapAction:"IGRS-CentralisedDeviceGroup-Advertisement"	Required field
	Shall be empty
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">	Required field
<SOAP-ENV:Body>	Required field
<DeviceOperation xmlns="http://www.igrs.org/spec1.0">	Required field, see Clause B.1 of ISO/IEC 14543-5-1
<DeviceGroupId> Device Group ID </DeviceGroupId>	Required field, see 8.2.3 of ISO/IEC 14543-5-1
<DeviceGroupName> device group name</DeviceGroupName>	Required field
<DeviceGroupType> Centralized:av:MediaDeviceGroup:CISDeviceGroup </DeviceGroupType>	Required field
</DeviceOperation>	Required field
</SOAP-ENV:Body>	Required field
</SOAP-ENV:Envelope>	Required field

7.2.4.4 Inner-group information exchange mechanism of content index service device group

As specified in 7.2.2 to supplement ISO/IEC 14543-5-1, a content index service device group supports two types of inner-group information exchange mechanisms: notification based on multicast and request/response message based on unicast.

The format of inner-group exchanged information is not specified in this subclause. The detailed strategy should be specified by the application developer and device manufacturer.

7.2.4.5 Group management mechanism of content index service device group

This subclause specifies the group management mechanism from the perspectives of the master device and slave device of the content index service device group. Refer to the specification in 7.2.3.

Figure 12 shows the group management mechanism from the perspective of CIS group master as follows.

a) A media server goes online and is set as the CIS group master.

b) Search the existing content index service device group in the current IGRS network:

   1) If the content index servicedevice group exists, the media server joins the group as a slave device and transfers its CIS metadata to the content directory of the CIS group master. Then it may leave the content index service device group and go offline.

   2) If no content index service device group exists, the media server creates the content index service device group as the CIS group master and sends the device group an online advertisement message. Then it allows another media server to join this group as a CIS group slave and uploads the CIS metadata on the CIS group slave to the content directory on the CIS group master. The CIS group master may subscribe to a content update event of the CIS group slave so that the CIS group master is notified whenever the content on the CIS group slave is updated. It allows the CIS group slave to leave the group. Lastly, it dismisses the content index service device group and goes offline.

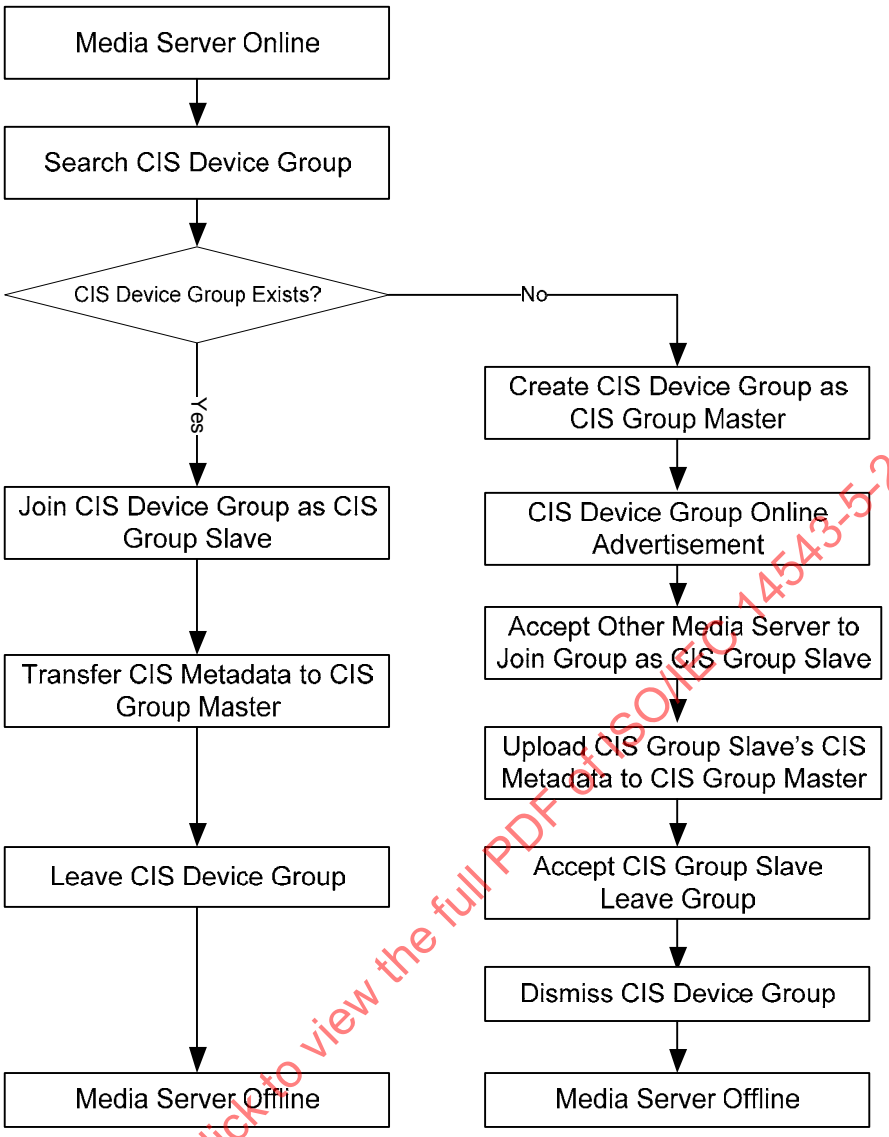

Figure 12 – Flow of content index service device group management from the perspective of media server set as CIS group master

Figure 13 shows the group management mechanism from the perspective of a CIS group slave as follows.

c) Media server goes online and is set as a CIS group slave.

d) Search the existing content index service device group in the current IGRS network:

1) If the content index servicedevice group exists, it joins the group and transfers its CIS metadata to the content directory on the CIS group master. Then it may leave the content index service device group and go offline.

2) If no content index service device group exists, the media server waits for a period of time, go to step d). The length of the waiting time should be specified by the application developer and device manufacturer.

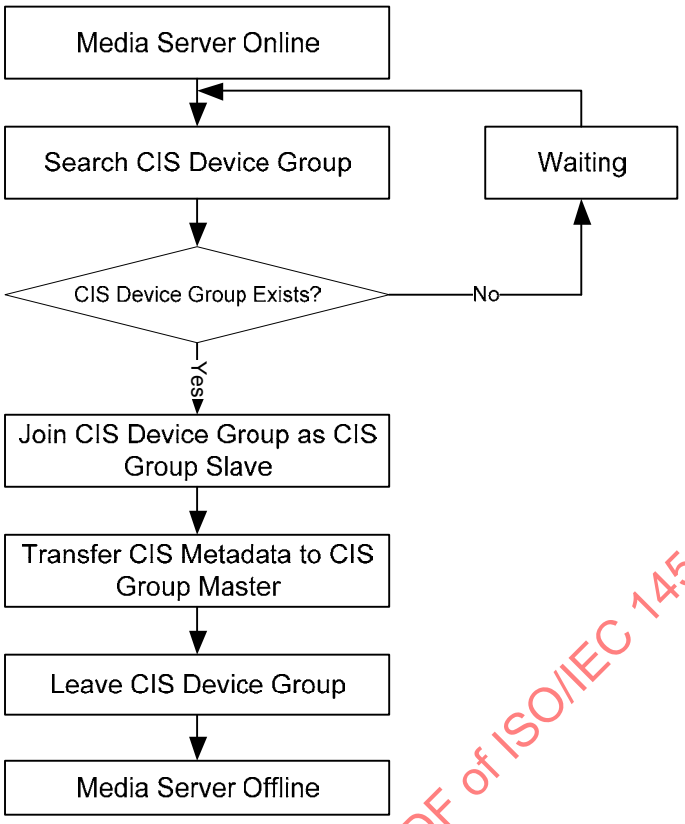

Figure 13 – Flow of content index service device group management from the perspective of a media server set as CIS group slave

7.2.5 Audio video multicast device group

7.2.5.1 General

An audio video multicast device group is a class of the IGRS media device group. It is composed of a media server (as the master device of the device group) and multiple media clients (as slave devices of the device group).

7.2.5.2 Group setup strategy of audio video multicast device group

More than one audio video multicast device group is allowed to exist simultaneously on an IGRS network at any time. One media server may create several audio video multicast device groups. One media client may join several audio video multicast device groups as slave device at the same time.

7.2.5.3 Audio video multicast device group online advertisement message

The master device shall send audio video multicast device group online advertisement messages (see 9.5.3.2 of ISO/IEC 14543-5-1) periodically. An XML element "DeviceGroupType" shall be added to the SOAP message body with a value that shall be: Centralized:av:MediaDeviceGroup:AVMCastDeviceGroup, as specified in Table 5.

Table 5 – Audio video multicast device group online advertisement message

Message	Field explanation
NOTIFY * HTTP/1.1	Extended HTTP COMMAND LINE
Host:239.255.255.250:3880	Required field
Cache-control:max-age=Max advertisement valid time	Required field, type is 32 bit unsignedInt (0 is reserved) when device receives this message and the time has expired, the device group no longer exists; before this max–age is reached, master device shall send new device group advertisement to reset this time, in units second (s)
Location: http://www.igrs.org/devicegroup/centralised	Required field, see Clause B.6 of ISO/IEC 14543-5-1
NT:uuid:Advertising Device Group Id	Required field, see 8.1.3 of ISO/IEC 14543-5-1
NTS:isdp:groupalive	Required field, ISDP requirement
SERVER: OS/version IGRS/1.0 product/version	Required field
USN:uuid:Advertising Device Group Id	Required field, see 8.1.3 of ISO/IEC 14543-5-1
MAN:"http://www.igrs.org/spec1.0";ns=01	Required field, see Clause B.1 of ISO/IEC 14543-5-1
01-IGRSVersion:IGRS/1.0	Required field, IGRS version number
01-IGRSMessageType:CentralisedDeviceGroupAdvertisement	Required field, content shall be this
01-SourceDeviceId: Source Device Id that is sending group advertisement	Required field, type is URI, specified in 8.1.2 of ISO/IEC 14543-5-1
Content-Type:text/xml; charset=utf-8	Required field
Content-Length: Message body length	Required field
MAN:"http://www.w3.org/2002/12/soap-envelope";ns=02	Required field
02-SoapAction:"IGRS-CentralisedDeviceGroup-Advertisement"	Required field
	Shall be empty
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/" SOAP-ENV:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">	Required field
<SOAP-ENV:Body>	Required field
<DeviceOperation xmlns="http://www.igrs.org/spec1.0">	Required field, see Clause B.1 of ISO/IEC 14543-5-1
<DeviceGroupId> Device Group ID </DeviceGroupId>	Required field, see 8.1.3 of ISO/IEC 14543-5-1
<DeviceGroupName> device group name </DeviceGroupName>	Required field
<DeviceGroupType> Centralized:av:MediaDeviceGroup:AVMCastDeviceGroup </DeviceGroupType>	Required field
</DeviceOperation>	Required field
</SOAP-ENV:Body>	Required field
</SOAP-ENV:Envelope>	Required field

7.2.5.4 Inner-group information exchange mechanism of audio video multicast device group

As specified in 7.2.2 to supplement ISO/IEC 14543-5-1, an audio video multicast device group supports two types of inner-group information exchange mechanisms: notification based on multicast and request/response message based on unicast.

The XML element of the inner-group exchanged information of the audio video multicast device group is specified as follows:

```
<McastInfo>
  <MediaFileURL>Media File URL</MediaFileURL>
   <McastAddr>Multicast Address</McastAddr>
</ McastInfo >
```

<MediaFileURL/> XML element contains the ObjectURI of multicast content, URI string type. <McastAddr/> XML element contains the multicast address, string type and the format is IP:Port, e.g. 239:255:255:100:1000, where IP is the multicast IP address and port is the bound port.

For a notification based on multicast, the above XML element shall be enclosed in <InfoExNotify/> element as a sub-element.

For a request message based on unicast, the above XML element shall be enclosed in <InfoExReq/> element with the values of <MediaFileURL/> and <McastAddr/> element set to empty.

For a response message based on unicast, the above XML element shall be enclosed in <InfoExRes/> element with the values of <MediaFileURL/> and <McastAddr/> element set to the exact value.

7.2.5.5 Group management mechanism of audio video multicast device group

This subclause describes the group management mechanism from the perspectives of a master device and a slave device of an audio video multicast device group. Refer to the definitions in 7.2.3.

Figure 14 shows the flow of the group management mechanism from the perspective of a master device in an audio video multicast device group, as follows:

a) a media server goes online;
b) create an audio video multicast device group and send an audio video multicast device group online advertisement;
c) the media server allows a media client to join the group as slave device;
d) multicast content is sent to a slave device;
e) allow the slave device to leave the group or the slave device goes offline;
f) dismiss the device group;
g) media server goes offline.

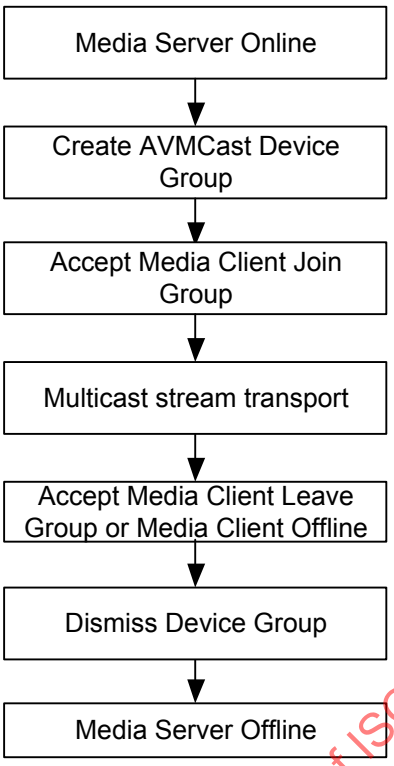

Figure 14 – Flow of AV multicast device group management from the perspective of master device

Figure 15 shows the group management mechanism from the perspective of slave device in audio video multicast device group, as follows:

h) the media client goes online;

i) search the existing audio video multicast device group in the current IGRS network;

j) select and join an audio video multicast device group;

k) play or record the multicast content from the master device;

l) the media client leaves the group;

m) the media client goes offline.

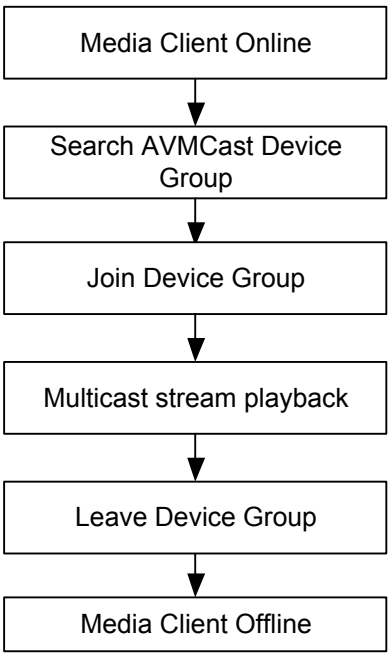

Figure 15 – Flow of audio video multicast device group management from the perspective of a slave device

7.3 Interaction flow of dynamic service invocation flow determination

In an IGRS AV system, an IGRS dynamic service invocation module may determine the service interaction flow of an AV application based on the capability match condition of the involved device or device group, as depicted in Figure 16.

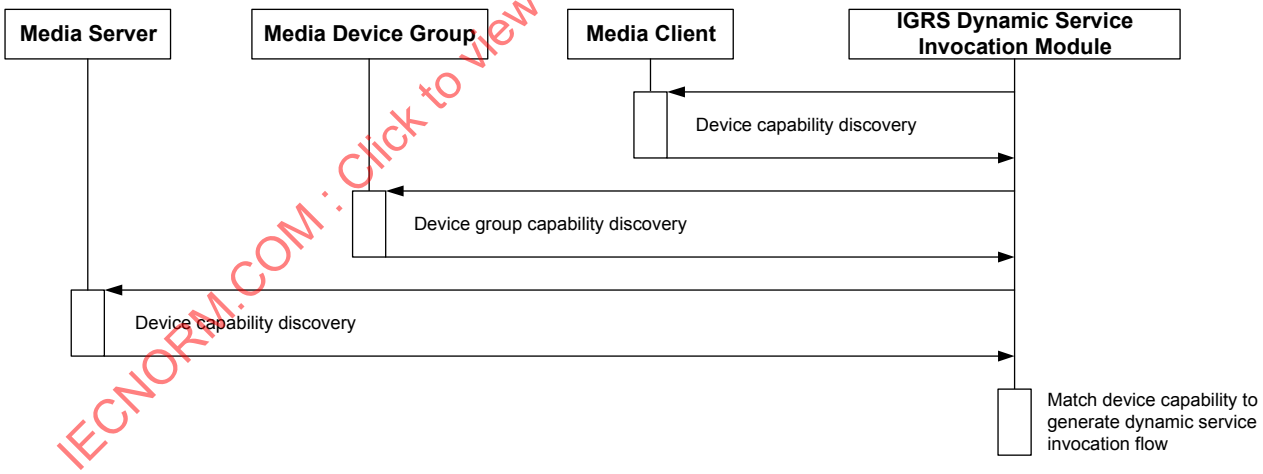

Figure 16 – Interaction flow of dynamic service invocation

The IGRS dynamic service invocation module shall first discover the application capabilities of a media server, media client or media device group and then match their capabilities to determine the appropriate dynamic service invocation flow. For example, if both media server and media client in an AV playback application support the IGRS QoS protocol, the IGRS QoS services shall be invoked to set up the traffic path; otherwise the QoS service shall not be invoked.

An IGRS dynamic service invocation module may determine the capabilities of a device by using the following methods.

a) The service type header (01-ServiceType) in the service online advertisement message indicates the IGRS standard service implementation information on the device (10.1.1 of ISO/IEC 14543-5-1).

b) The service online registration message of the slave device in the centralised device group reports the running service information on the slave device to the master device (10.1.2 of ISO/IEC 14543-5-1).

c) Search the running service on the device by sending a service search message (10.2 of ISO/IEC 14543-5-1).

d) Subscribe to the service online notification event of the device so that, whenever the service goes online, it sends a notification message to the IGRS dynamic service invocation module to report its service type (10.3 of ISO/IEC 14543-5-1).

The IGRS dynamic service invocation module may determine the capabilities of a device group by discovering the device group type of the device group according to 9.8 of ISO/IEC 14543-5-1.

7.4 Interaction flow of AV playback

7.4.1 General

This subclause describes the interaction flow of an IGRS AV playback application. Figure 17 depicts the flow of an IGRS dynamic service invocation module co-ordinating the service invocation between the media server and media client according to the procedure specified in 7.3.

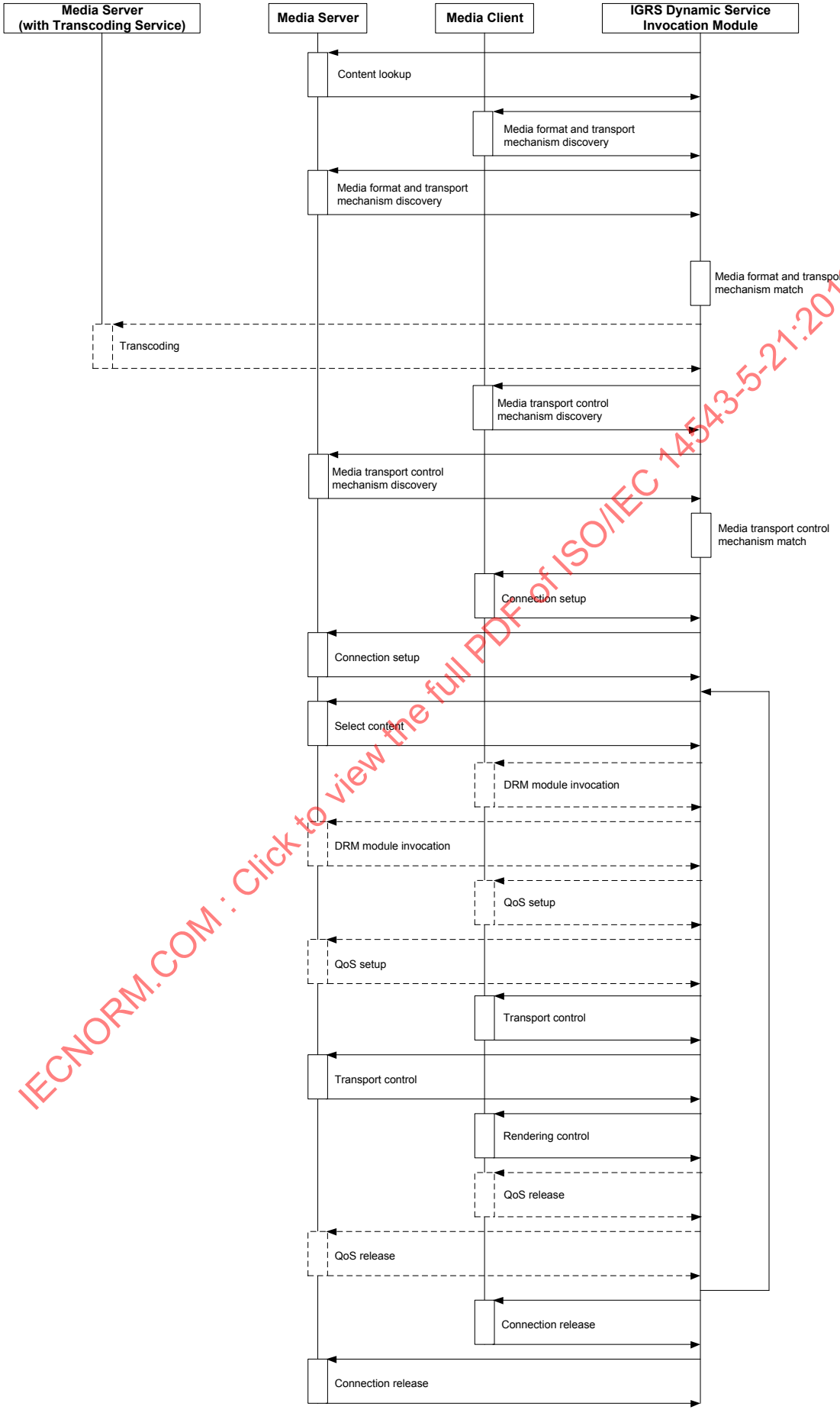

Figure 17 – Interaction flow of AV playback

The interaction flow of an IGRS AV playback application is as follows.

a) Content lookup: the IGRS dynamic service invocation module browses content managed by a media server. The Browse() and Search() interface of the content index service may be used to discover contents (refer to ISO/IEC 14543-5-6).

b) Media format and transport mechanism discovery: the IGRS dynamic service invocation module discovers the media format and transport mechanism supported by media server and media client. The media format information and transport mechanism may be obtained by the GetProtocolInfo() interface of the connection management service (refer to connection management service in ISO/IEC 14543-5-6) or from the local configuration of device.

c) Media format and transport mechanism match: the IGRS dynamic service invocation module matches the media format and transport mechanism supported by the media server and media client.

d) Transcoding: if the media server and media client cannot match the media format of the content and the IGRS dynamic service invocation module discovers that the media server has transcoding capability (i.e. content index service of the media server implements ConvertMediaFormat() interface), it requests the media server to transcode the media format of the content.

e) Media transport control mechanism discovery: the IGRS dynamic service invocation module discovers the transport control mechanism supported by the media server and media client: either a back channel message based transport control mechanism or a simple object access protocol based transport control mechanism. The transport control mechanism may be obtained by the GetProtocolInfo() interface of the connection management service (refer to ISO/IEC 14543-5-6) or from the local configuration of the device.

f) Media transport control mechanism match: the IGRS dynamic service invocation module matches the media transport control mechanism supported by the media server and media client; if both mechanisms are supported, the back channel message based transport control mechanism shall be used.

g) Connection setup: the IGRS dynamic service invocation module sets up a connection between a media server and media client. For the BCM-based connection management and transport control mechanism, refer to Clause 9 in ISO/IEC 14543-5-6; for SOAP-based connection management and transport control mechanism, refer to 8.2 in ISO/IEC 14543-5-6.

h) Select content: the IGRS dynamic service invocation module selects the content to be played. For a BCM-based connection management and transport control mechanism, refer to Clause 9 in ISO/IEC 14543-5-6; for SOAP-based connection management and transport control mechanism, refer to 8.3 and 8.4 in ISO/IEC 14543-5-6.

i) DRM module invocation: if the content is copyrighted, the IGRS DRM system is invoked to execute the proper process.

j) QoS setup: if the content to be played requires QoS support, the IGRS QoS system is invoked to setup the transport path.

k) Transport control: the IGRS dynamic service invocation module controls the transport of the media stream, such as play, pause, stop, etc. For a BCM-based connection management and transport control mechanism, refer to Clause 9 in ISO/IEC 14543-5-6; for SOAP-based connection management and transport control mechanism, refer to 8.3 and 8.4 in ISO/IEC 14543-5-6.

l) Rendering control: the IGRS dynamic service invocation module controls the rendering of content, such as adjust brightness, tune loudness, etc., refer to 8.5 of ISO/IEC 14543-5-6.

m) QoS release: if the content playback has QoS support, IGRS QoS system is invoked to release the setup of a transport path.

n) Connection release: the IGRS dynamic service invocation module releases the connection between media server and media client. For a BCM-based connection management and transport control mechanism, refer to Clause 9 in ISO/IEC 14543-5-6;

for SOAP-based connection management and transport control mechanism, refer to 8.2 in ISO/IEC 14543-5-6.

The IGRS AV playback application supports two types of out-of-band media stream transport modes: media server initiated transport and media client initiated transport. In the media server initiated transport mode, the media server is responsible for the transport control of the media stream. In the media client initiated transport mode, the media client is responsible for the transport control of the media stream.

The IGRS AV playback application also supports two out-of-band media stream transport control mechanism: back channel message based transport control and simple object access protocol based transport control.

Due to the differences among the out-of-band transport initiating parties and the transport control mechanisms, the IGRS AV playback application shall require different components and interaction procedures. 7.4.2 describes the device composition and interaction flow of media server initiated out-of-band transport. 7.4.3 describes the device composition and interaction flow of media client initiated out-of-band transport.

7.4.2 Media server initiated transport mode

7.4.2.1 General

Subclause 7.4.2.2 describes the device composition and interaction flow of a media server and media client for back channel message-based transport control mechanisms. Subclause 7.4.2.3 describes the device composition and interaction flow of media server and media client for simple object access protocol based transport control mechanism.

7.4.2.2 Back channel message based transport control mechanism

In this mode, when the IGRS dynamic service invocation module is located on a media client, as shown in Figure 18, the media server shall implement the BCM server of the BCM TCP service and the media client shall implement the BCM client of the BCM TCP service. When the IGRS dynamic service invocation module is located on a media server, as shown in Figure 19, the media server shall implement the BCM client of the BCM TCP service and the media client shall implement the BCM server of the BCM TCP service. The BCM client sends BCM command to control the out-of-band media stream between the media server and media client.

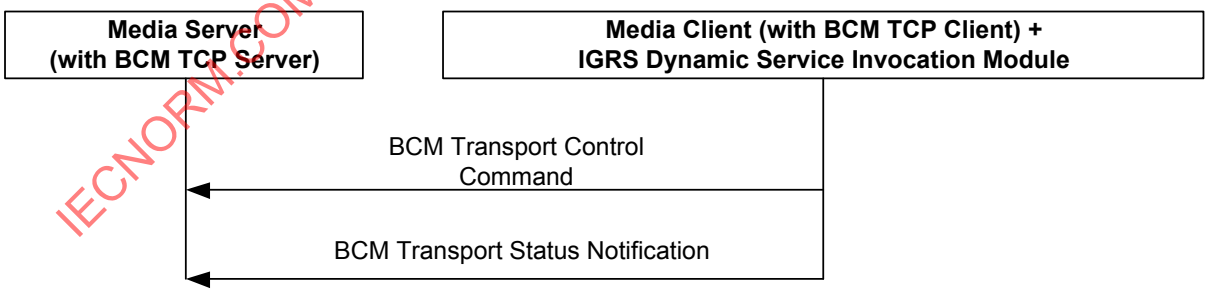

Figure 18 – Control of media server initiated transport based on BCM (IGRS dynamic service invocation module located on media client)

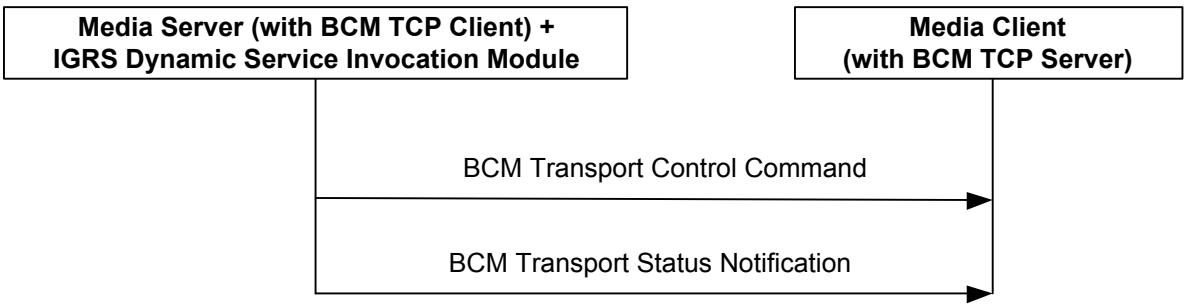

Figure 19 – Control of media server initiated transport based on BCM (IGRS dynamic service invocation module located on a media server)

7.4.2.3 Simple object access protocol based transport control mechanism

In this mode, the media server shall implement the media server transport management service (MSTMS) and the IGRS dynamic service invocation module invokes the SOAP interface function specified in MSTMS to control the out-of-band media stream. The detailed interaction flow is depicted in Figure 20.

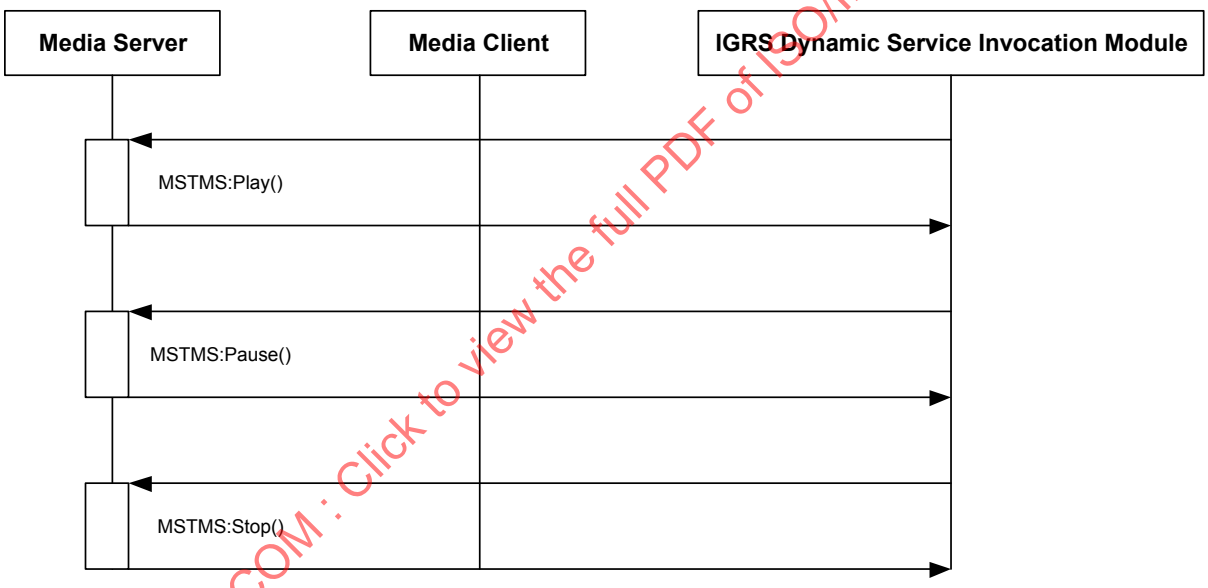

Figure 20 – Control of media server initiated transport based on SOAP

7.4.3 Media client initiated transport mode

7.4.3.1 General

Subclause 7.4.3.2 describes the device composition and interaction flow of a media server and media client for a back channel message-based transport control mechanism. Subclause 7.4.3.3 describes the device composition and interaction flow of a media server and media client for a simple object access protocol-based transport control mechanism.

7.4.3.2 Back channel message based transport control mechanism

In this mode, when the IGRS dynamic service invocation module is located on a media client, as shown in Figure 21, the media server shall implement the BCM server of a BCM TCP service and the media client shall implement the BCM client of a BCM TCP service. When the IGRS dynamic service invocation module is located on a media server, as shown in Figure 22, the media server shall implement the BCM client of a BCM TCP service and the media client

shall implement the BCM server of BCM TCP service. The BCM client sends a BCM command to control the out-of-band media stream between the media server and media client.

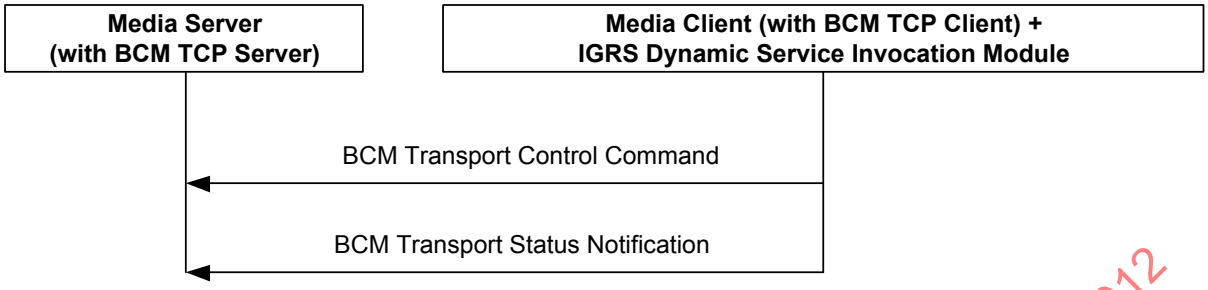

Figure 21 – Control of a media client initiated transport based on BCM (IGRS dynamic service invocation module located on a media client)

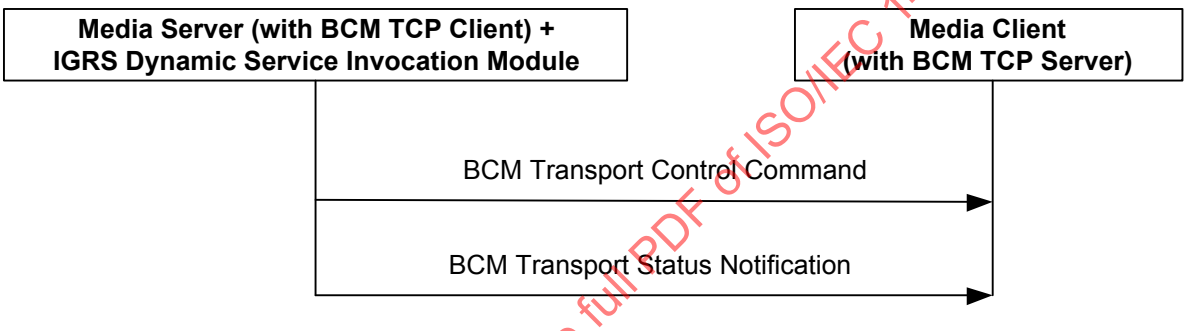

Figure 22 – Control of media client initiated transport based on BCM (IGRS dynamic service invocation module located on media server)

7.4.3.3 Simple object access protocol based transport control mechanism

In this model, the media client shall implement the media client transport management service (MCTMS) and the IGRS dynamic service invocation module invokes the SOAP interface function specified in MCTMS to control the out-of-band media stream. The detailed interaction flow is depicted in Figure 23.

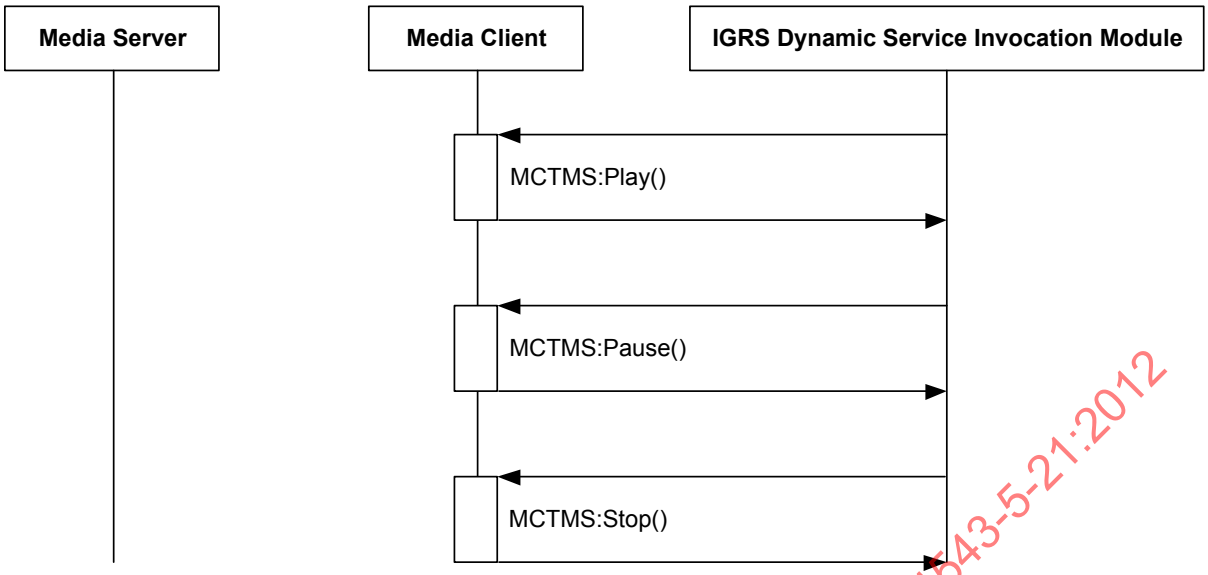

Figure 23 – Control of media client initiated transport based on SOAP

7.5 Interaction flow of multicast AV playback

The multicast AV playback procedure shall be required when

- the metadata of content stored and managed by the content index service includes an attribute of an ObjectURI starting with "rtspmu://" (refer to ISO/IEC 14543-5-6) and AVMCastGroupName (refer to ISO/IEC 14543-5-6), and
- the media client chooses to play the content through the multicast ObjecURI in the AV playback procedure.

According to the multicast AV playback procedure, if an AVMCastGroupName metadata does not exist or is set to empty, the media client that intends to start the multicast playback session shall trigger the media server to create an audio video multicast device group according to the specification in 7.2.5 and shall set the AVMCastGroupName metadata to the group name of the created audio video multicast device group and then join that group. If the AVMCastGroupName metadata is not empty, the media client that intends to join the multicast playback session shall join the audio video multicast device group according to the specification in 7.2.5. Figure 24 depicts the flow of multicast AV playback.

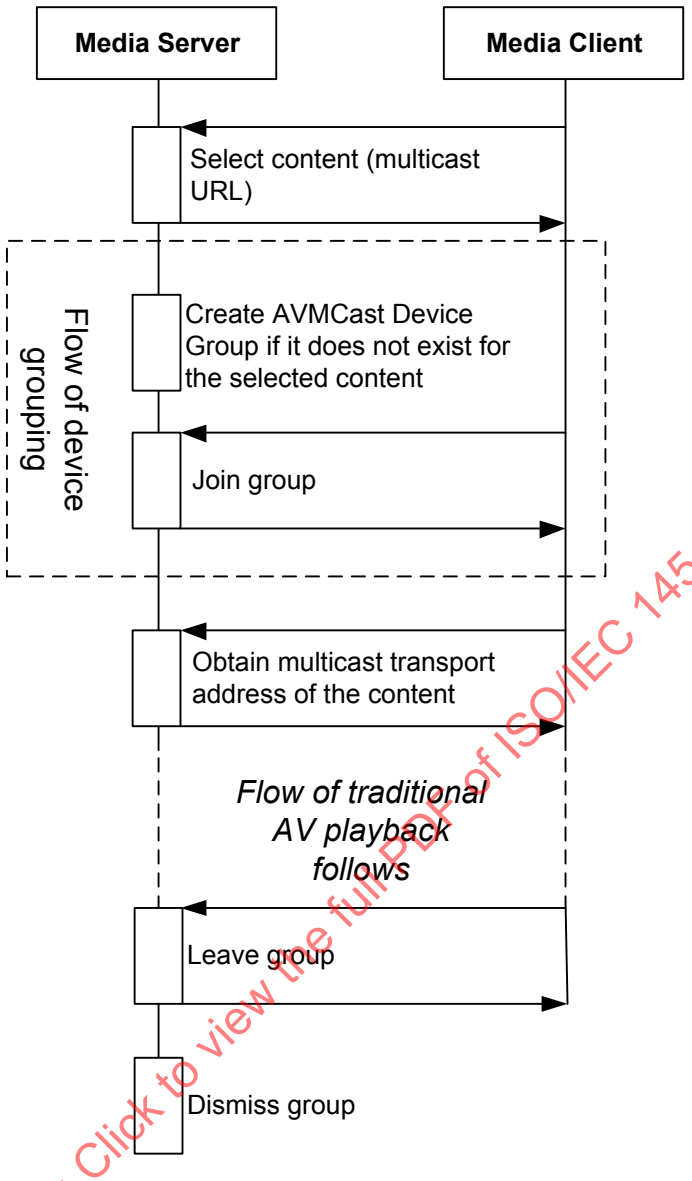

Figure 24 – Flow of multicast AV playback

If the media server receives a multicast playback request and finds no audio video multicast device group available for the content, it shall create an audio video multicast device group, set the AVMCastGroupName metadata of the content to the group name of the created audio video multicast device group, allocate a multicast address for the device group and send a device group online advertisement message.

The specific steps of the flow process are described as follows.

a) Media client browses content in the content directory of a media server and selects multicast an ObjectURI to play the content.

b) If the media server receives the multicast playback request and finds no audio video multicast device group available for the content, it shall create an audio video multicast device group, set the AVMCastGroupName metadata to the group name of the created audio video multicast device group, allocate a multicast address for the device group and send an audio video multicast device group online advertisement message.

c) Media client searches and joins the audio video multicast device group for the content.

d) Media client obtains a multicast playback address from the media server according to the specification in 7.2.2.

e) Media client accesses the multicast playback address according to the specification in 7.4 and starts to play the content.

f) The media client leaves the audio video multicast device group.

g) If there is no media client in the audio video multicast device group, the media server dissolves the device group.

7.6 Interaction flow of content management

7.6.1 General

This subclause describes the interaction flow of the IGRS AV application of the content management type. The IGRS AV system supports two types of content management applications: collaborative content analysis and personalised content recommendation.

7.6.2 Interaction flow of collaborative content analysis

The content index service device group supports the functionality of distributed content collaboration by distributed collaboration of content index services on multiple media servers. The interaction flow is depicted in Figure 25 and described as follows.

a) Set up the content index service device group according to the specification of 7.2.4.5.

b) The CIS group master obtains the content directory of the CIS group slave, imports the content metadata on the CIS group slave but not the content. The CIS group master ObjectURI metadata for the content stored on CIS group slave then points to content on the CIS group slave. If the CIS group slave requests the CIS group master to help analyse the metadata of the content, it shall specify this metadata attribute as an empty XML element.

c) The CIS group master checks whether the the metadata of the content from a CIS group slave is an empty XML element.

d) If the metadata of a certain content is an empty XML element, the CIS group master determines that the CIS group slave is requesting to analyse this metadata and shall obtain the content from the CIS group slave, analyse the content, generate a metadata and send the newly generated metadata to the CIS group slave. Upon receiving the new metadata, the CIS group slave shall combine this metadata with the original that may be stored locally into a more complete metadata and then update the content directory and a copy on the CIS group master through a notification.

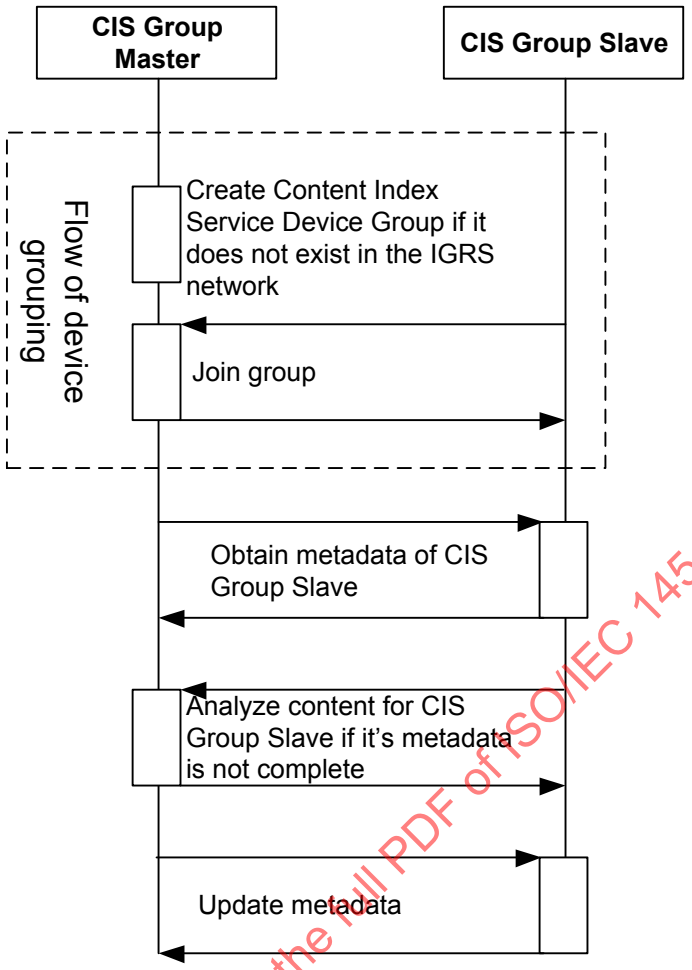

Figure 25 – Interaction flow of collaborative content analysis

The interaction flow between the media client and the content index service device group is depicted in Figure 26 and described as follows.

e) The media client accesses the content index service device group by sending a request to the CIS group master to obtain the content directory.

f) The media client browses the content directory and obtains the access address of the content (ObjectURI metadata):

   1) if the ObjectURI points to a CIS group master, the media client accesses content directly from the CIS group master;

   2) if the ObjectURI points to a CIS group slave, the media client accesses the CIS group slave for content.

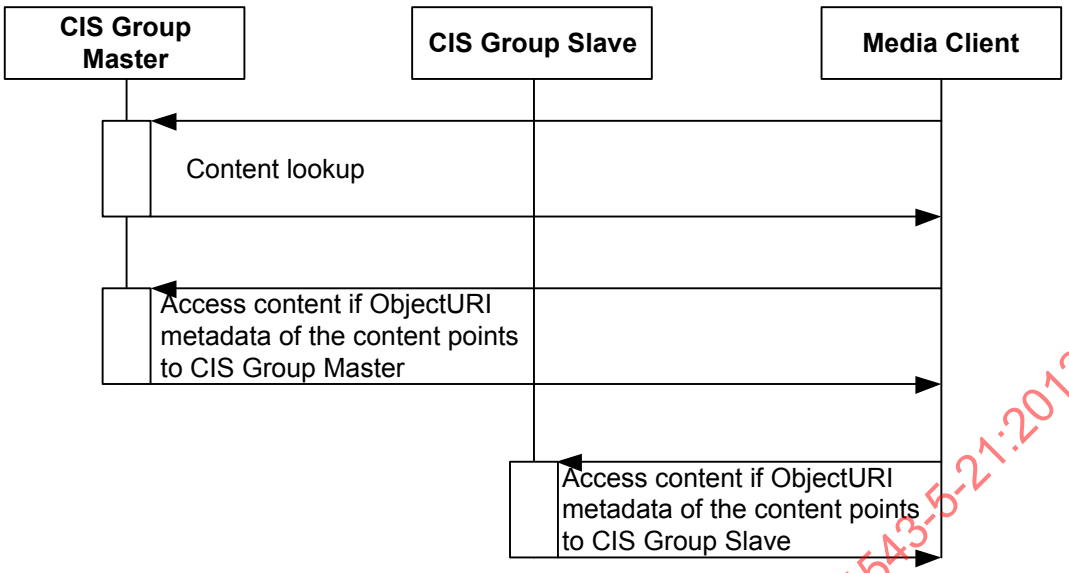

Figure 26 – Interaction flow of a media client accessing a content index service device group

7.6.3 Interaction flow of a personalised content recommendation

An IGRS AV system supports personalised content recommendation management by analysing the preference of the users. Personalised content recommendation is implemented in the content index service of the media server and may be classified into two modes.

- Offline mode, i.e., generating a recommended content list for the user in the content directory of the media server according to the user preference.
- Online mode, i.e., sending a personalised content recommendation request to the media server. The media server replies with a related content list.

The interaction flow of the offline personalised content recommendation is depicted in Figure 27.

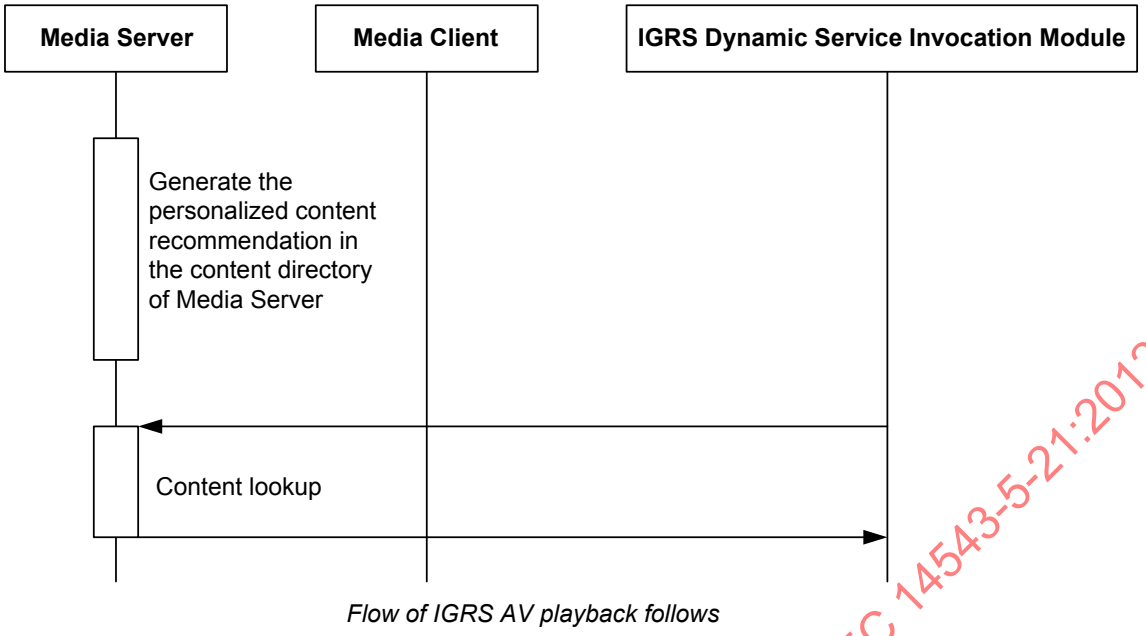

Figure 27 – Flow of content recommendation by offline personalisation

The interaction flow of the online personalised content recommendation is depicted in Figure 28.

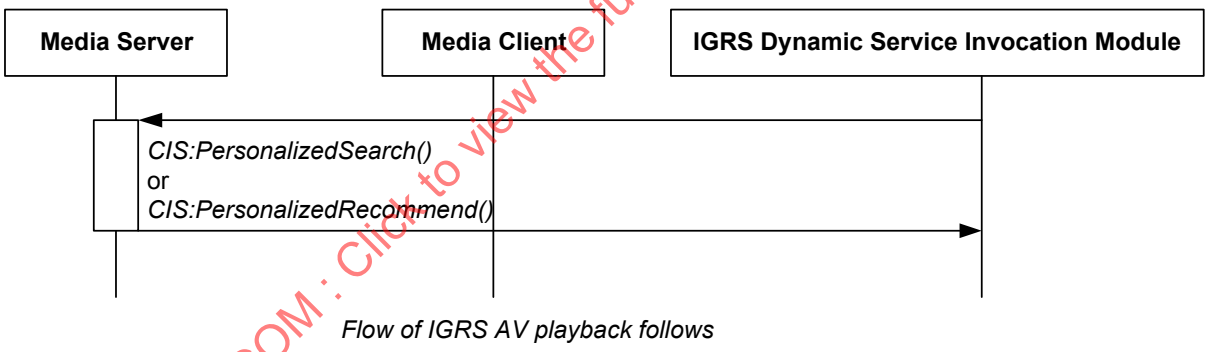

Figure 28 – Flow of content recommendation by online personalization

8 Session

8.1 Session setup

After discovering a service on the target IGRS device through the service discovery mechanism, an IGRS client may establish a supporting environment for subsequent service access through the session setup mechanism based on a device pipe.

An IGRS service may obtain service access control by gathering the authorised user and device access list for this service. IGRS services should set up the maximum number of concurrent accesses.

IGRS device relationships are determined by whether devices are located in the same device group, whether the IGRS client device is the trusted device of the IGRS service device and whether the IGRS client device is the specified trusted device of the IGRS service device.