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ITU-T J.1102

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SERIES J: CABLE NETWORKS AND TRANSMISSION OF TELEVISION, SOUND PROGRAMME AND OTHER MULTIMEDIA SIGNALS

Switched digital video over cable networks

Interface specifications for IP-based switched digital video using DOCSIS

Recommendation ITU-T J.1102

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Interface specifications for IP-based switched digital video using DOCSIS

Summary

Recommendation ITU-T J.1102 describes the interface specifications for IP-based switched digital video (SDV) using data over cable service interface specifications (DOCSIS) in a digital cable network. The cable broadcasting system has been changed to use resources efficiently and to transmit said resources in such a way that the varying needs of subscribers are easily accommodated. The interface specifications described in this Recommendation are defined according to Recommendation ITU-T J.1101, *Functional requirements for IP-based switched digital video using data over cable service interface specifications*. These specifications are designed to maintain quality of service (QoS) while using bandwidth effectively in a hybrid fiber/coaxial (HFC) network environment.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T J.1102	2015-08-13	9	11.1002/1000/12571

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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Interface specifications for IP-based switched digital video using DOCSIS

1 Scope

This Recommendation defines the interface specifications of the IP-based switched digital video (SDV) using data over cable service interface specification (DOCSIS). The interface specifications described in this Recommendation are defined according to [ITU-T J.1101]. The interface specifications described in this Recommendation are defined as follows:

– management interface specification for the session management function

– management interface specification for the resource management function.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T J.222.1] Recommendation ITU-T J.222.1 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems: Physical layer specification.*

[ITU-T J.222.2] Recommendation ITU-T J.222.2 (2007), *Third-generation transmission systems for interactive cable television services – IP cable modems: MAC and Upper Layer protocols.*

[ITU-T J.1101] Recommendation ITU-T J.1101 (2012), *Functional requirements for IP-based switched digital video using data over cable service interface specifications*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 IP-based switched digital video (SDV): Service mechanism to provide interfaces and functionalities to enable cable television system operators to offer QoS-guaranteed broadcasting and multicasting.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CCP Channel Charge Protocol

CM Cable Modem

CMTS Cable Modem Termination System

CRC	Cyclic Redundancy Check
DA	Destination Address
DC	Downstream Channel
DCID	Downstream Channel Identifier
DEPI	Downstream External PHY Interface
DMPI	DOCSIS MAC-PHY Interface
DOCSIS	Data Over Cable Service Interface Specifications
DRFI	Downstream Radio Frequency Interface
DS	Downstream
DSID	Downstream Service Identifier
EH	Extended Header
EHDR	Extended MAC Header
FC	Frame Control
FEC	Forward Error Correction
FTP	File Transfer Protocol
GBE	Giga Bit Ethernet
HCS	Header Check Sequence
HFC	Hybrid Fiber/Coaxial
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPC	Inter Process Communications
LAN	Local Area Network
MAC	Media Access Control
M-CMTS	Modular Cable Modem Termination System
MDD	MAC Domain Descriptor
MIB	Management Information Base
MPEG	Moving Picture Experts Group
MSB	Most Significant Bit
NSI	Network Service Interface
PDU	Protocol Data Unit
PHY	Physical Layer
PID	Packet Identifier
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
RPC	Remote Procedure Call
SA	Source Address
SCI	IP-based SDV Control Interface

SDI IP-based SDV Data Interface

SDV Switched Digital Video

SF Service Flow

SFID Service Flow Identifier

SID Service Identifier

SIP Session Initiation Protocol

STB Set-Top Box

VSI Video Service Interface

5 Conventions

In this Recommendation:

The keywords "**is required to**" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "**is recommended**" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The keywords "**is prohibited from**" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "**can optionally**" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

In the body of this Recommendation and its annexes, the words *shall*, *shall not*, *should*, and *may* sometimes appear, in which case they are to be interpreted, respectively, as *is required to*, *is prohibited from*, *is recommended*, and *can optionally*. The appearance of such phrases or keywords in an appendix or in material explicitly marked as *informative* are to be interpreted as having no normative intent.

6 IP-based SDV reference model

As shown in Figure 1, functionally IP-based SDV using the DOCSIS system can be categorized into three parts:

– the transmission function

– the subscriber function

– the control function.

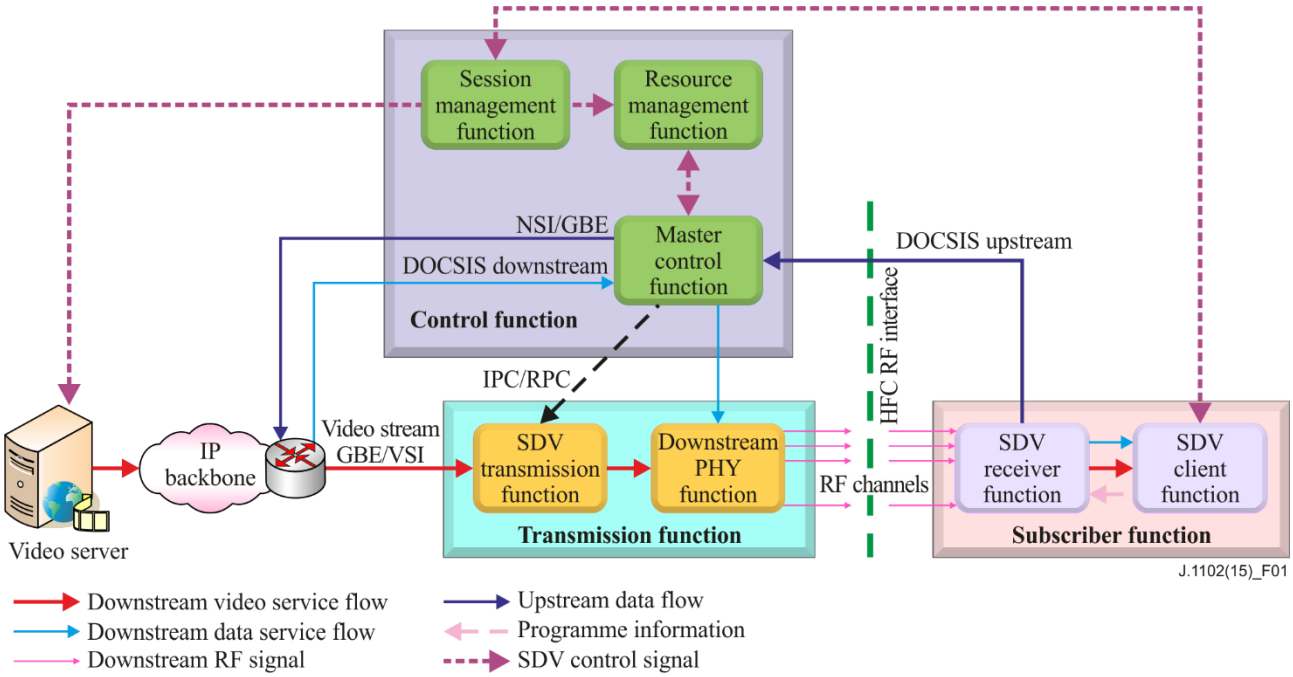

Figure 1 – Diagram of an IP-based switched digital video system

6.1 Transmission function

The transmission function processes the DOCSIS frame header and transmits it to the multicast service group. The transmission function consists of an SDV transmission function and a downstream PHY function. The SDV transmission function processes service flow and packet header processing on the DOCSIS MAC layer [ITU-T J.222.2]. The downstream PHY function transmits the DOCSIS header processed video stream to the subscriber.

6.1.1 SDV transmission function

The SDV transmission function processes service flow and does packet header processing on the DOCSIS MAC layer.

6.1.2 Downstream PHY function

The downstream PHY [ITU-T J.222.1] function transmits the DOCSIS header processed video stream to the subscriber.

6.2 Subscriber function

The subscriber function processes the video data stream from the transmission function. The subscriber function consists of the SDV client service function and SDV receiver function. The subscriber function also sends request information of an SDV video service programme to the control function.

6.2.1 SDV client function

The SDV client function recovers an IP-based received video data stream from an MPEG-2 based video stream and outputs it to the set-top box (STB).

6.2.2 SDV receiver function

The SDV receiver function processes physical signal processing; it is a function of the DOCSIS cable modem.

7 Interface structure

IP-based SDV system is required to consist of IP-based SDV data interface (SDI) and IP-based SDV control interface (SCI). The SDI-1 provides the interface between the IP-based SDV transmission module and head-end local network. The SDI-2 provides the interface between MAC and PHY in the IP-based SDV transmission module. The SDI-3 provides the interface between the IP-based SDV transmission module and the modular cable modem termination system (M-CMTS). The SCI-1 provides the interface between the set-top box (STB) and the session management server. The SCI-2 provides the interface between the session management server and the resource management server. The SCI-3 provides the interface between the resource management server and the M-CMTS. The SCI-4 provides the interface between the M-CMTS and the IP-based SDV transmission module. The interface structure of the IP-based SDV is shown in Figure 2.

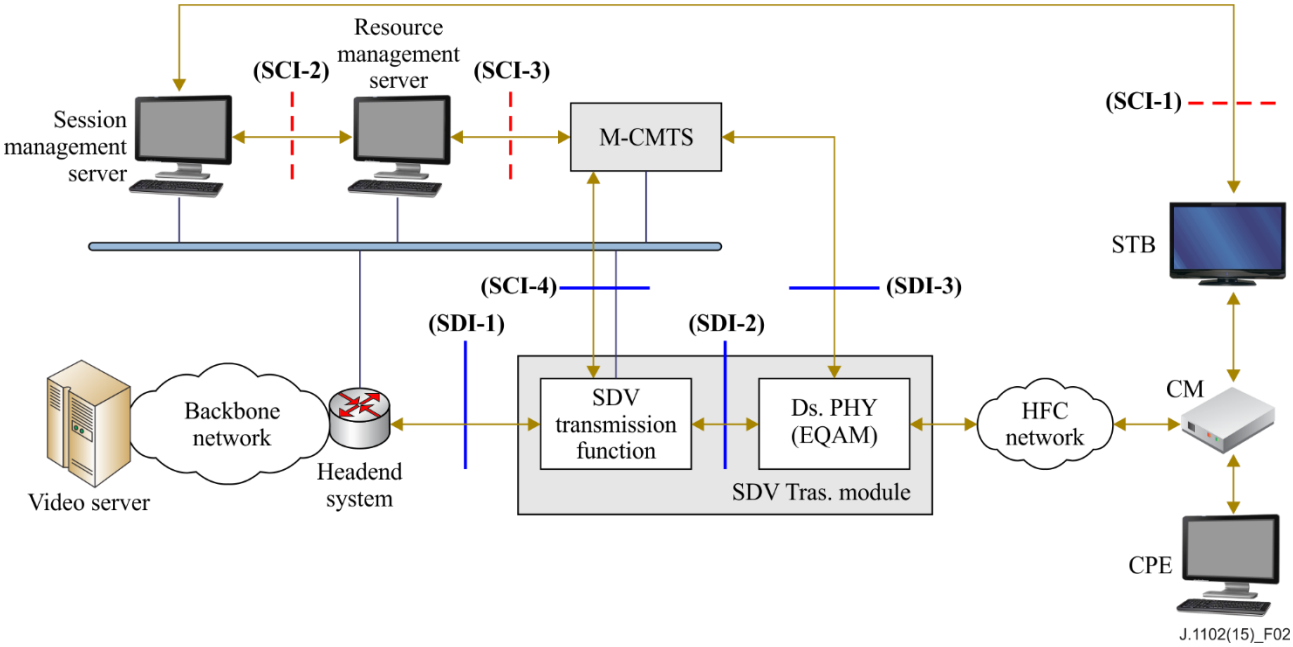

Figure 2 – The interface structure of IP-based SDV

7.1 SDI-1

The SDI-1 is defined as the interface specification between the SDV transmission module and the headend local network system. The SDI-1 is recommended to transmit the IP-based video data stream of the backbone network or local area network (LAN) to the IP-based transmission module. The headend local network system is recommended to connect the session and resource management server using IP protocol. The headend local system is recommended to connect the control and management of the SDV transmission module using IP protocol.

7.2 SDI-2

The SDI-2 is defined as the internal interface specification between the MAC and the PHY submodules in the SDV transmission module. The SDI-2 is recommended to connect between the MAC function submodule and the downstream PHY submodule. The SDI-2 is recommended to transmit the DOCSIS MAC frame which is created in the SDV transmission module to the frequency channel using the downstream PHY submodule.

The transmission of the DOCSIS MAC frame to the downstream PHY submodule is recommended to support three formats as follows:

– DOCSIS MAC over MPEG-2 TS

– DOCSIS MAC over MPEG-2 TS over IP

– DOCSIS MAC over IP

7.3 SDI-3

The SDI-3 is defined as the interface specification between the M-CMTS and the SDV transmission module.

The SDI-3 consists of two interfaces as follows:

– Downstream MAC/PHY interface

– Upstream MAC/PHY interface

The SDI-3 is recommended to transmit the DOCSIS MAC frame to the downstream PHY transmission submodule of the SDV transmission module.

The SDI-3 is recommended to transmit the information of the upstream burst stream to the MAC submodule.

7.4 SCI-1

The SCI-1 is defined as the control interface specification between the STB and the session management server.

The SCI-1 is recommended to obtain the information of the programme channel and the IP group address.

7.5 SCI-2

The SCI-2 is defined as the control interface between the session management server and the resource management server.

The SCI-2 is recommended to reserve the frequency channel resource.

The SCI-2 is recommended to transmit the information of the transmission frequency and QoS.

7.6 SCI-3

The SCI-3 is defined as the control interface between the resource management server and the M-CMTS.

The SCI-3 is recommended to manage the frequency channel resource.

7.7 SCI-4

The SCI-4 is defined as the control interface between the M-CMTS and the SDV transmission module.

The SCI-4 is recommended to transmit and receive the control message using IP protocol.

8 Interface specification

8.1 Session management function

The session management function is required to receive the request of the programme service and to set the path for the transmission of video streaming. The session management function consists of the following:

– Session protocol processing

– Session information management

– Resource management interface

– Programme information table management

8.1.1 Session protocol processing

Session protocol processing is required to transmit and receive the relevant protocol unit in accordance with session initiation protocol (SIP)/channel change protocol (CCP). Figure 3 shows the programme select protocol transmitted and received between the session management server and subscribers.

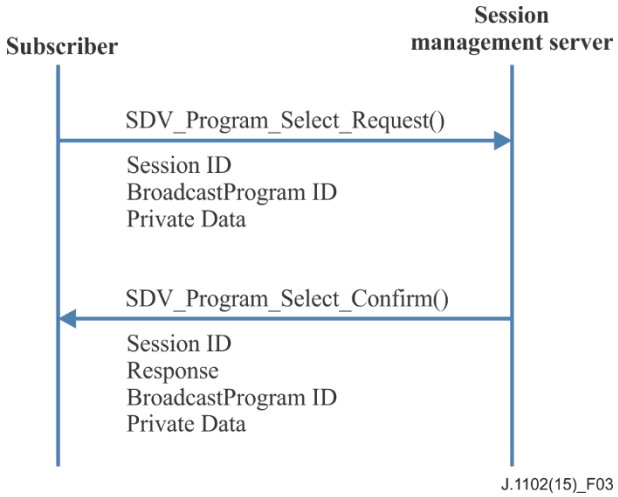

Figure 3 – The programme select protocol

Table 1 shows the syntax of an SDV channel change protocol message.

Table 1 – Syntax of an SDV channel change protocol message

SDV_Channel_Change_Protocol_Message() { DSMCC_Message_Header Message_Payload }	

Table 2 shows the syntax of a session set-up protocol message.

Table 2 – Syntax of a session set-up protocol message

Session_Setup_Protocol_Message() { DSMCC_Message_Header Message_Payload }	

Table 3 shows the syntax of a DSMCC message header.

Table 3 – Syntax of a DSMCC message header

DSMCC_Message_Header() {	
ProtocolDiscriminator	**1 byte**
DSMCC_Type	**1 byte**
MessageID	**2 bytes**
TransactionID	**4 bytes**
reserved	**1 byte**
Adaptation_Length	**1 byte**
Message_Length	**2 bytes**
if(adaptationLength>0) {	
DSMCC_Adaptation_Header() {	
}	
}	

Table 4 shows and describes message IDs and message names.

Table 4 – Message ID type

MessageID	Message name	Description
0x0000	Reserved	ISO/IEC 13818-6 reserved
0x0001	SDV_Program_Select_Request	Sent from a user to the SDB server to request that a broadcast programme be provided
0x0002	SDV_Program_Select_Confirm	Sent from the SDB server to a user in response to the SDBProgramSelectRequest
0x0003	SDV_Program_Select_Indication	Sent from the SDB server to a user to indicate that a new broadcast programme will be provided
0x0004	SDV_Program_Select_Response	Sent from a user to the SDB server in response to the SDBProgramSelect indication message
0x0005~0x7FFF	Reserved	ISO/IEC 13818-6 reserved
0x8000~0xFFFF	User defined	User defined SDB message

Table 5 shows and describes programme ID types.

Table 5 – Programme ID type

Broadcast ProgramID	Broadcast programme name	Description
0x00000000	NoProgram	Identifies that a broadcast programme has not been selected or indicated
0x00000001 ~ 0x7FFFFFFF	Broadcast Program Numbers	Uniquely identifies a single broadcast programme
0x80000000 ~ 0xFFFFFFFF	User defined	User defined special purpose SDB broadcast ProgramIDs

8.1.2 Session information management

Session information management is required to set up the multicast session and respond to the IP group address on the session.

8.1.3 Resource management interface

The resource management interface is required to transmit and receive data between session management and resource management.

8.1.4 Programme information table management

Programme information table management is required to operate the programme information table. Programme information table management is required to update the information table whenever there are any changes on the multicast session.

8.2 Resource management function

The resource management function is required to manage the frequency channel resources in charge of transmission in the HFC network.

The resource management function is required to satisfy the QoS standards and operate available channel resource information.

The resource management function consists of the following:

– resource protocol processing
– resource information management
– session management interface

8.2.1 Resource protocol processing

Resource protocol processing is required to allocate the frequency channel resource.

8.2.2 Resource information management

Resource information management is required to manage the frequency channel resources.

8.2.3 Session management interface

The session management interface is required to create and transmit the protocol units for the interface between session management and resource management.

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