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

Switched digital video over cable networks

Control specification for IP-based switched digital video using data over cable service interface specifications

Recommendation ITU-T J.1104

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Control specification for IP-based switched digital video using data over cable service interface specifications

Summary

Recommendation ITU-T J.1104 describes the operator control specifications of IP-based switched digital video (SDV) using data over cable service interface specifications (DOCSIS) in digital cable networks. The cable broadcasting system has been changed to use resources efficiently and to transmit them to easily accommodate the varying needs of the subscriber. Therefore, it is necessary to define the transmission specifications for Recommendation ITU-T J.1101, which supports the maintaining of quality of service (QoS) and using bandwidth effectively in a hybrid fiber/coaxial (HFC) network environment.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T J.1104	2016-10-14	9	11.1002/1000/13056

* 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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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

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Control specification for IP-based switched digital video using data over cable service interface specifications

1 Scope

This Recommendation defines the operator control specifications of the IP-based switched digital video (SDV) using data over cable service interface specification (DOCSIS). The operator control specifications described in this Recommendation are defined as follows: system control and monitoring by operator.

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.222.2] 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*.

[ITU-T J.1102] Recommendation ITU-T J.1102 (2015), *Interface specifications for IP-based switched digital video using DOCSIS*.

[ITU-T J.1103] Recommendation ITU-T J.1103 (2015), *Transmission specification for IP-based switched digital video using data over cable service interface specifications*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 IP-based switched digital video (SDV) [ITU-T J.1101]: A service mechanism which provides interfaces and functionalities to enable cable television system operators to offer QoS guaranteed broadcasting and multicasting.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CM Cable Modem

CMTS Cable Modem Termination System

DOCSIS Data Over Cable Service Interface Specifications

DS	Downstream
GBE	Giga Bit Ethernet
HFC	Hybrid Fiber/Coaxial
IP	Internet Protocol
IPC	Inter Process Communications
MAC	Media Access Control
NSI	Network Service Interface
PHY	Physical Layer
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
RPC	Remote Procedure Call
SDV	Switched Digital Video
VSI	Video Service Interface

5 Conventions

The keywords "**is required to"** indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation 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 Recommendation 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, for example, 'Transmission function', 'Subscriber function' and 'Control function'.

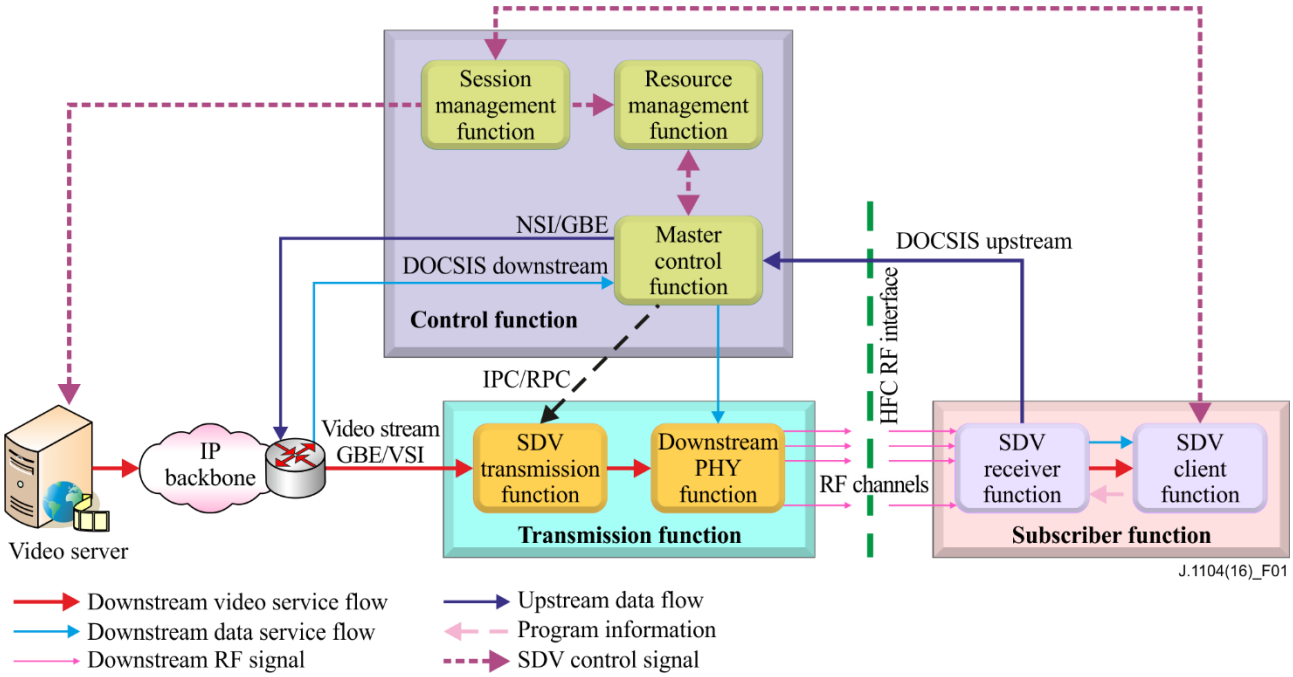

Figure 1 – Diagram of an IP-based switched digital video system

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 (DS) physical layer (PHY) function. The SDV transmission function processes service flow and packet header processing on the DOCSIS media access control (MAC) layer [ITU-T J.222.2]. The downstream PHY 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 the request information of an SDV video service programme to the control function.

7 Operator control specification

7.1 Operator control

The operator control function is required to input the following information:

– System control and device management

– System performance monitoring

– System alarm

– System event

The operator control function transmits and receives messages between device management function and operator interface function. The device management function exchanges information through inter process communications (IPC) messages. All messages being received and transmitted by IPC management unit use IPC message type.

The message format of an operator control specification is shown in Figure 2. A detailed definition is provided in Table 1. It has message ID per feature of message and per message type as header,

depending on the format of receiving and transmission of messages. Message data can be defined in different length and format depending on message types.

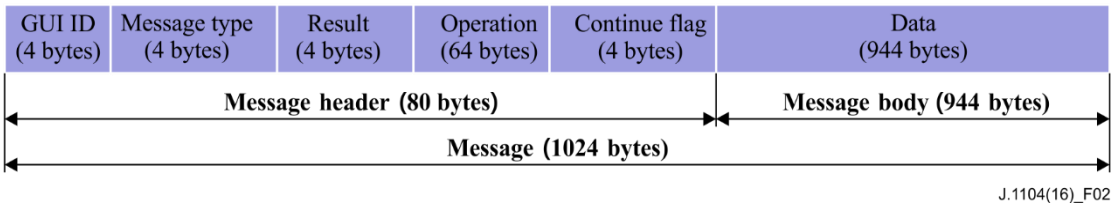

Figure 2 – Message format

Table 1 – Message header

Field	Length(byte)	Function
GUI_ID	4 (Integer)	ID
MESSAGE_TYPE	4 (Integer)	1000: Command 2000: configuration file load 3000: configuration file save 4000: library call for statistic 5000: library call for port monitoring 6000: notify alarm
RESULT	4 (Integer)	0: NO RESULT 1: OK
Operation	64 (String)	Depend on MESSAGE_TYPE COMMAND (IF MESSAGE_TYPE =1000) File Path (IF MESSAGE_TYPE=2000 or 3000) NAME OF CALL METHOD (IF MESSAGE_TYPE=4000 or 5000) NO USED : IF MESSAGE_TYPE=6000 NO USED: IF RESULT: NO
CONTINUE_FLAG	4 (integer)	0: NO CONTINUE 1: CONTINUE
DATA	944 (String)	COMMAND RESULT CONFIGURATION FILE INFORMATION STATISTIC INFORMATION PORT MONITORING INFORMATION NOTIFY ALARM INFORMATION REASON INFORMATION AS NO RESULT

7.2 Control and management sub-function

Control and management sub-function consists of the following two sub-functions:

– Device management

– Configuration file load

For device management, the request/response message communication between the device-managing block, which is located in target board, and the GUI operator interfacing block of the monitoring system, which is located in remote server, is carried out using TCP/IP.

As shown in Figure 3, the monitoring system sends a req_dev_manage( ) message to the target system. When the target system receives the req_dev_manage( ) message, it sends a rsp_dev_manage( ) message to the monitoring system.

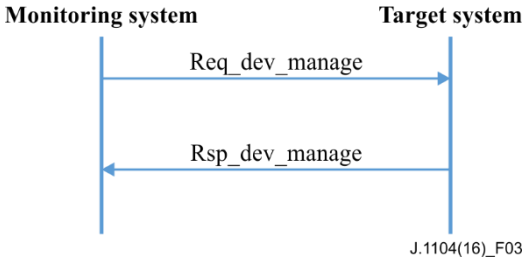

Figure 3 – Message communication procedure for device management

The req_dev_manage( ) message is the request message for device management. It uses the message format shown in Table 2.

Table 2 – Req_dev_manage( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Command = 1000
3	int	dataSize	4 bytes	Message size
4	int	operation	64 bytes	Command
5	int	continue	4 bytes	Continue flag
6	String	data	944 bytes	No used

The rsp_dev_manage( ) message is the response message for device management. It uses the message format as shown in Table 3.

Table 3 – Rsp_dev_manage( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Command = 1000
3	int	dataSize	4 bytes	Message size
4	int	operation	64 bytes	Command
5	int	continue	4 bytes	Continue flag
6	String	data	944 bytes	Command result

When the configuration file is uploaded, the monitoring system sends a req_cfg_fileload( ) message to the target system. When the target system receives the req_cfg_fileload( ) message, it sends a rsp_cfg_fileload ( ) message to the monitoring system.

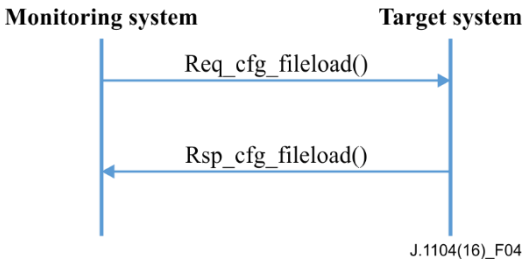

Figure 4 – Message communication procedure for configuration file load

The req_cfg_fileload( ) message shown in Figure 4 is the request message for configuration of file loading. It uses the message format shown in Table 4.

Table 4 – Req_cfg_fileload( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	ConfigFile_Load = 2000
3	int	dataSize	4 bytes	Message size
4	int	operation	64 bytes	Command
5	int	continue	4 bytes	Continue flag
6	String	data	944 bytes	No used

The rsp_cfg_fileload( ) message is the response message for configuration of file loading. It uses the message format shown in Table 5.

Table 5 – Rsp_cfg_fileload( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	ConfigFile_Load = 2000
3	int	dataSize	4 bytes	Message size
4	int	operation	64 bytes	Command
5	int	continue	4 bytes	Continue flag
6	String	data	944 bytes	File result

7.3 Performance monitoring sub-function

Performance monitoring sub-function consists of the following sub-functions:

– Start collecting the statistic information
– Stop collecting the statistic information
– Start collecting the channel statistic information
– Stop collecting the channel statistic information

The block displays the failure and status collecting and analysing the overall status information, and delivers the result to operator. The status information delivered to an operator through operator interface shall be easily recognizable to an operator on the status and failure information in real-time. When failure occurs, it shall be made possible for an operator to check information through operator

interface by deciding occurrence location, severity and urgency of the failure. It shall also be possible to perform a feature of display and save the received information on status and failure.

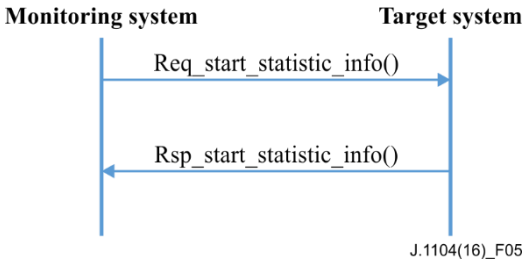

Figure 5 – Message communication procedure to start collecting statistics information of performance monitoring

The req_start_statistic_info( ) message is the request message to start collecting statistic information. It uses the message format shown in Table 6:

Table 6 – Req_start_statistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 4000
3	int	period	4 bytes	Period
4	int	method	64 bytes	Command
5	int	action	4 bytes	Start = 1
6	String	statData	944 bytes	No used

The rsp_start_statistic_info( ) message is the response message to start collecting statistics information. It uses the message format shown in Table 6.

Table 7 – Rsp_start_statistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 4000
3	int	period	4 bytes	Period
4	int	method	64 bytes	Command
5	int	action	4 bytes	Start = 1
6	String	statData	944 bytes	No used

To stop collecting statistics information, the monitoring system sends a req_stop_statistic_info( ) message to the target system. When the target system receives the req_stop_statistic_info( ) message, it sends a rsp_stop_statistic_info( ) message to the monitoring system. The target system sends a rpt_statistic_info( ) message to the monitoring system to report the statistics information.

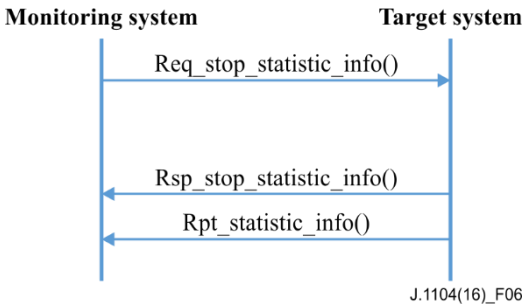

Figure 6 – Message communication procedure to stop collecting statistics information of performance monitoring

The req_stop_statistic_info( ) message is the request message to stop collecting statistics information. It uses the message format shown in Table 8.

Table 8 – Req_stop_statistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 4000
3	int	period	4 bytes	Period
4	int	method	64 bytes	Command
5	int	action	4 bytes	Stop = 0
6	String	statData	944 bytes	No used

The rsp_stop_statistic_info( ) message is the response message to stop collecting statistics information., It uses the message format shown in Table 9.

Table 9 – Rsp_stop_statistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 4000
3	int	period	4 bytes	Period
4	int	method	64 bytes	Command
5	int	action	4 bytes	Stop = 0
6	String	statData	944 bytes	No used

The rpt_statistic_info( ) message is the report message for collecting statistics information. It uses the message format shown in Table 10.

Table 10 – rpt_statistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 4000
3	int	result	4 bytes	Collecting results
4	int	method	64 bytes	Command
5	int	action	4 bytes	Not used
6	Byte	statData	944 bytes	Statistic data

To start collecting the channel statistic information, the monitoring system sends a req_start_chstatistic_info( ) message to target system. As the target system receives the req_start_chstatistic_info( ) message, it sends the rsp_start_chstatistic_info( ) message to the monitoring system.

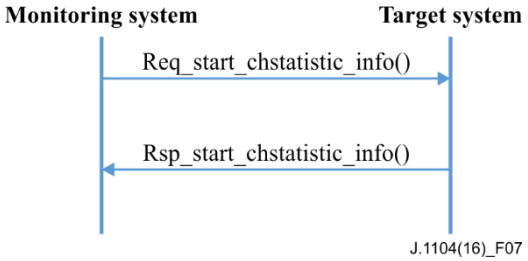

Figure 7 – Message communication procedure to start collecting channel statistics information of performance monitoring

The req_start_chstatistic_info( ) message is the request message to start collecting channel statistics information. It uses message format shown in Table 11.

Table 11 – Req_start_chstatistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Channel_Monitoring = 5000
3	int	period	4 bytes	Period
4	int	method	64 bytes	Command
5	int	action	4 bytes	Start = 1
6	String	statData	944 bytes	Not used

The rsp_start_chstatistic_info( ) message is the response message to start collecting channel statistics information. It uses the message format shown in Table 12.

Table 12 – Rsp_start_chstatistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Channel_Monitoring = 5000
3	int	period	4 bytes	Period
4	int	method	64 bytes	Command
5	int	action	4 bytes	Start = 1
6	String	statData	944 bytes	No used

To stop collecting the channel statistic information, the monitoring system sends a req_stop_chstatistic_info( ) message to the target system. When the target system receives the req_stop_chstatistic_info( ) message, it sends a rsp_stop_chstatistic_info( ) message to the monitoring system, and the target system sends a rpt_chstatistic_info( ) message to the monitoring system.

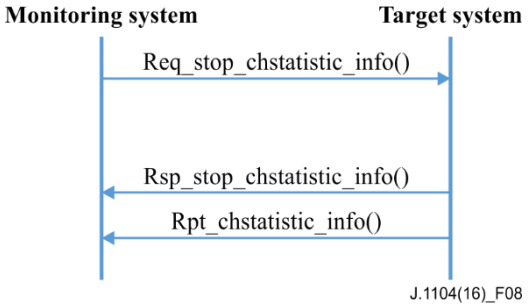

Figure 8 – Message communication procedure to stop collecting channel statistics information of performance monitoring

The req_stop_chstatistic_info( ) message is the request message to stop collecting channel statistics information. It uses the message format shown in Table 13.

Table 13 – Req_stop_chstatistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 5000
3	int	period	4 bytes	Period
4	int	method	64 bytes	Command
5	int	action	4 bytes	Stop = 0
6	String	statData	944 bytes	Not used

The rsp_stop_chstatistic_info( ) message is the response message to stop collecting statistics information. It uses the message format shown in Table 14.

Table 14 – Rsp_stop_statistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 5000
3	int	period	4 bytes	Message size
4	int	method	64 bytes	Command
5	int	action	4 bytes	Stop = 0
6	String	statData	944 bytes	Not used

The rpt_chstatistic_info( ) message is the report message for collecting channel statistics information. It uses the message format shown in Table 15.

Table 15 – rpt_statistic_info( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	GUI ID
2	int	messageType	4 bytes	Stat_Monitoring = 5000
3	int	result	4 bytes	Collecting results
4	int	method	64 bytes	Command
5	int	action	4 bytes	Not used
6	Byte	statData	944 bytes	Statistic data

7.4 Alarm status reporting sub-function

Event reporting sub-function is reporting the alarm status to the operator.

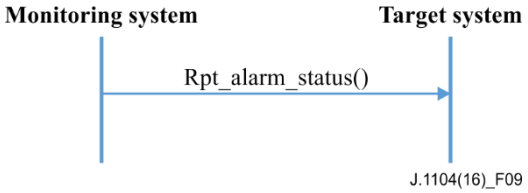

Figure 9 – Message communication procedure for event reporting

Table 16 – rpt_alarm_status( )

	Type	Name	Length	Description
1	int	guiId	4 bytes	Not used
2	int	messageType	4 bytes	Stat_Monitoring = 6000
3	int	result	4 bytes	Not used
4	int	method	64 bytes	Not used
5	int	action	4 bytes	Not used
6	Byte	statData	944 bytes	Notify Alarm Status

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