ITUPublications
Recommendations

International Telecommunication Union
Standardization Sector

Recommendation

ITU-T J.299 (07/2023)

SERIES J: Cable networks and transmission of television, sound programme and other multimedia signals

Cable set-top box

Functional requirements for remote management of cable set-top boxes by auto configuration server

ITU-T J-SERIES RECOMMENDATIONS

Cable networks and transmission of television, sound programme and other multimedia signals

GENERAL RECOMMENDATIONS	J.1-J.9
GENERAL SPECIFICATIONS FOR ANALOGUE SOUND-PROGRAMME TRANSMISSION	J.10-J.19
PERFORMANCE CHARACTERISTICS OF ANALOGUE SOUND-PROGRAMME CIRCUITS	J.20-J.29
EQUIPMENT AND LINES USED FOR ANALOGUE SOUND-PROGRAMME CIRCUITS	J.30-J.39
DIGITAL ENCODERS FOR ANALOGUE SOUND-PROGRAMME SIGNALS – PART 1	J.40-J.49
DIGITAL TRANSMISSION OF SOUND-PROGRAMME SIGNALS	J.50-J.59
CIRCUITS FOR ANALOGUE TELEVISION TRANSMISSION	J.60-J.69
ANALOGUE TELEVISION TRANSMISSION OVER METALLIC LINES AND INTERCONNECTION WITH RADIO-RELAY LINKS	J.70-J.79
DIGITAL TRANSMISSION OF TELEVISION SIGNALS	J.80-J.89
ANCILLARY DIGITAL SERVICES FOR TELEVISION TRANSMISSION	J.90-J.99
OPERATIONAL REQUIREMENTS AND METHODS FOR TELEVISION TRANSMISSION	J.100-J.109
INTERACTIVE SYSTEMS FOR DIGITAL TELEVISION DISTRIBUTION (DOCSIS FIRST AND SECOND GENERATIONS)	J.110-J.129
TRANSPORT OF MPEG-2 SIGNALS ON PACKETIZED NETWORKS	J.130-J.139
MEASUREMENT OF THE QUALITY OF SERVICE – PART 1	J.140-J.149
DIGITAL TELEVISION DISTRIBUTION THROUGH LOCAL SUBSCRIBER NETWORKS	J.150-J.159
IPCABLECOM (MGCP-BASED) – PART 1	J.160-J.179
DIGITAL TRANSMISSION OF TELEVISION SIGNALS – PART 1	J.180-J.189
CABLE MODEMS AND HOME NETWORKING	J.190-J.199
APPLICATION FOR INTERACTIVE DIGITAL TELEVISION – PART 1	J.200-J.209
INTERACTIVE SYSTEMS FOR DIGITAL TELEVISION DISTRIBUTION (DOCSIS THIRD TO FIFTH GENERATIONS)	J.210-J.229
MULTI-DEVICE SYSTEMS FOR CABLE TELEVISION	J.230-J.239
MEASUREMENT OF THE QUALITY OF SERVICE – PART 2	J.240-J.249
DIGITAL TELEVISION DISTRIBUTION THROUGH LOCAL SUBSCRIBER NETWORKS	J.250-J.259
IPCABLECOM (MGCP-BASED) – PART 2	J.260-J.279
DIGITAL TRANSMISSION OF TELEVISION SIGNALS – PART 2	J.280-J.289
CABLE SET-TOP BOX	**J.290-J.299**
APPLICATION FOR INTERACTIVE DIGITAL TELEVISION – PART 2	J.300-J.309
MEASUREMENT OF THE QUALITY OF SERVICE – PART 3	J.340-J.349
IPCABLECOM2 (SIP-BASED) – PART 1	J.360-J.379
DIGITAL TRANSMISSION OF TELEVISION SIGNALS – PART 3	J.380-J.389
MEASUREMENT OF THE QUALITY OF SERVICE – PART 4	J.440-J.449
IPCABLECOM2 (SIP-BASED) – PART 2	J.460-J.479
DIGITAL TRANSMISSION OF TELEVISION SIGNALS – PART 4	J.480-J.489
TRANSPORT OF LARGE SCREEN DIGITAL IMAGERY	J.600-J.699
SECONDARY DISTRIBUTION OF IPTV SERVICES	J.700-J.799
MULTIMEDIA OVER IP IN CABLE	J.800-J.899
TRANSMISSION OF 3-D TV SERVICES	J.900-J.999
CONDITIONAL ACCESS AND PROTECTION	J.1000-J.1099
SWITCHED DIGITAL VIDEO OVER CABLE NETWORKS	J.1100-J.1119
SMART TV OPERATING SYSTEM	J.1200-J.1209
IP VIDEO BROADCAST	J.1210-J.1219
CLOUD-BASED CONVERGED MEDIA SERVICES FOR IP AND BROADCAST CABLE TELEVISION	J.1300-J.1309
TELEVISION TRANSPORT NETWORK AND SYSTEM DEPLOYMENT IN DEVELOPING COUNTRIES	J.1400-J.1409
ARTIFICIAL INTELLIGENCE (AI) ASSISTED CABLE NETWORKS	J.1600-J.1649

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T J.299

Functional requirements for remote management of cable set-top boxes by auto configuration server

Summary

Recommendation ITU-T J.299 describes the functional requirements for auto configuration server (ACS) and set-top box (STB) connected to each other for the purpose of remote maintenance. ACS is usually used to remotely set up and maintain customer premises equipment (CPE) such as an STB. The major purpose of the Recommendation is to specify basic requirements for remote maintenance in the cable TV system.

History *

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T J.299	2020-05-29	9	11.1002/1000/14279
2.0	ITU-T J.299	2022-01-13	9	11.1002/1000/14867
3.0	ITU-T J.299	2023-07-14	9	11.1002/1000/15591

Keywords

ACS, set-top box, auto configuration server, cable, customer premises equipment, functional requirements, remote maintenance, STB, TV.

* To access the Recommendation, type the URL https://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents/software copyrights, 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 appropriate ITU-T databases available via the ITU-T website at http://www.itu.int/ITU-T/ipr/.

Table of Contents

Recommendation ITU-T J.299

Functional requirements for remote management of cable set-top boxes by auto configuration server

1 Scope

This Recommendation defines the functional requirements for the interface between auto configuration server (ACS) at the cable headend or other cable operator locations and cable set-top box (STB) to remotely set up and maintain the STB and collect data from the STB. In addition, a function to enable network address translation (NAT) traversal and a means to securely handle the collected data are also considered.

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 H.741.1] Recommendation ITU-T H.741.1 (2012), *IPTV application event handling: Audience measurement operations for IPTV services*.

[ITU-T H.741.2] Recommendation ITU-T H.741.2 (2012), *IPTV application event handling: Data structures of audience measurement for IPTV services*.

[ITU-T H.741.3] Recommendation ITU-T H.741.3 (2012), *IPTV application event handling: Audience measurement for IPTV distributed content services*.

[ITU-T H.741.4] Recommendation ITU-T H.741.4 (2012), *IPTV application event handling: Transport mechanisms for audience measurement*.

[BBF TR-069] Broadband Forum, *CPE WAN Management Protocol Issue:1 Amendment 6 Corrigendum 1, 2020/6*.

[BBF TR-135] Broadband Forum (2012), *Data Model for a TR-069 Enabled STB Issue:1 Amendment 3*.

[IETF RFC 8489] IETF (2020), *Session Traversal Utilities for NAT (STUN)*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 data model [BBF TR-069]: A hierarchical set of parameters that define managed objects for a particular device or service.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 radio frequency log: Data log that consists of a record of the receive conditions at a radio frequency equivalent to the TV channel selected by a set-top box (STB) user.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACS Auto Configuration Server

CPE Customer Premises Equipment

GDPR General Data Protection Regulation

NAT Network Address Translation

ONU Optical Network Unit

RF Radio Frequency

STB Set-Top Box

STUN Session Traversal Utilities for Network address translations

XMPP Extensible Messaging and Presence Protocol

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 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 "**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*, *should* and *may* sometimes appear, in which case they are to be interpreted, respectively, as *is required to*, *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 Overview

The ACS is usually installed in a cable operator's premises and has functions to, for example, remotely set up a new STB, remotely monitor its status and modify its parameters. The ACS can also be used to collect data from STBs including audience measurement results. This is a good tool to alleviate the cable operator's workload.

However, most ACS are tailored to control STBs from the same manufacturer, with control functions and methods differing from one manufacturer to another. This limits the operator's possibility to purchase STBs from multiple vendors. The purpose of this Recommendation is to make ACS and STBs from different manufactures interoperable with each other by defining requirements including a set of common data models for harmonization of the management from the ACS to the STB.

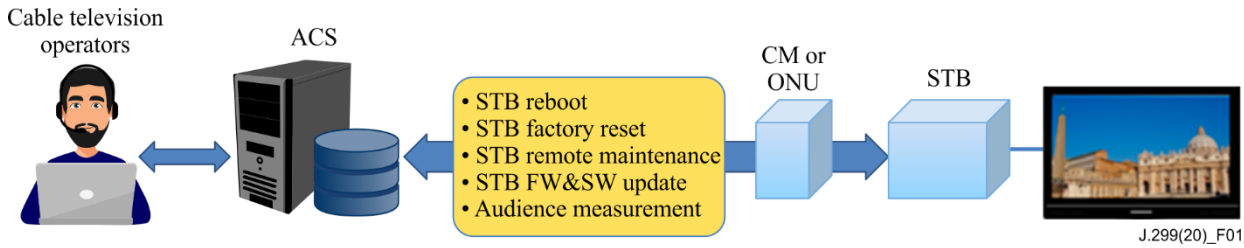

Figure 1 – Overview of ACS and STB configuration

Figure 1 shows the typical configuration of this system. There is usually a cable modem or an optical network unit (ONU) in front of the STB, which is installed in the user's residence and has a NAT function that works in an IPv4 environment.

The protocol between ACS and STB is not specified in this Recommendation, but one of the globally standardized protocols that is in use for this purpose is the CPE WAN management protocol [BBF TR-069]. [BBF TR-135] defines data models that specify objects and parameters used in messages between ACS and STB to conduct the functions. [b-Jlabs SPEC-038] can be referred to as one of the regional standards that adopt [BBF TR-069] and [BBF TR-135]. With regard to audience measurement, ITU-T Recommendations for IPTV [ITU-T H.741.1], [ITU-T H.741.2], [ITU-T H.741.3] and [ITU-T H.741.4] can be referenced.

Information collected by the audience measurement function must be used within the cable operator the user subscribes to.

7 Requirements

7.1 General requirements

ACSstb-GenralReq-01 – The ACS and STB are required to implement the functions of initial set-up of STB, remote maintenance, firmware and software upgrade and audience measurement.

ACSstb-GenralReq-02 – The ACS and STB are required to support Ipv4 and Ipv6 on the interface between them. If there are STBs working on an Ipv4 private address, the ACS is required to support NAT traversal. For this purpose, the ACS is required to support NAT transversal of at least one of the following methods to reach STBs on an IPv4 private address:

– XMPP-based mechanism defined in Annex K of [BBF TR-069];

– STUN defined in [IETF RFC 8489].

ACSstb-GenralReq-03 – An ACS should be able to be shared by cable operators if they agree to share it.

ACSstb-GenralReq-04 – The ACS and STB are required to implement a security function to protect against fraudulent use.

ACSstb-GenralReq-05 – The ACS and STB are required to have a mechanism to balance data traffic between them in order to avoid traffic congestion. As an example of the techniques used for balancing audience measurement reports from STBs, ACS can divide STBs into groups and assign a different report timing to each group.

7.2 Initial set-up of the STB

ACSstb-SetupReq-01 – At startup, an STB is required to notify the ACS of its firmware and software version. The ACS may decide to conduct a firmware and software upgrade under cable operator's policy when the version of the STB is older than that of the firmware stored in the ACS. The STB user may also decide to do so.

ACSstb-SetupReq-02 – At start-up, an STB is required to have means to indicate the field engineer whether it has been set up with the data relevant to the cable operator to which the user subscribes.

ACSstb-SetupReq-03 – The ACS is required to transfer set-up information to a new STB in case of STB replacement due to failure or change of user location.

ACSstb-SetupReq-04 – An STB should have functions to avoid congestion caused by simultaneous access from a bulk of STBs in the same area to the ACS after power or line failure.

7.3 Remote maintenance

ACSstb-RemoteReq-01 – At the request of the ACS, an STB is required to send the ACS information of the STB and equipment connected to the STB, e.g., STB operation status and a list of connected devices.

ACSstb-RemoteReq-02 – At the request of the ACS, an STB is required to modify the initial parameter set, e.g., username and password used for connection set-up between the ACS and STB.

ACSstb-RemoteReq-03 – At the request of the ACS, an STB is required to initialize itself to factory default values.

ACSstb-RemoteReq-04 – At the request of the ACS, an STB is required to reboot its system. It is recommended to be able to reboot built-in Wi-Fi module or CM as well.

ACSstb-RemoteReq-05 – An STB reboot should be avoided while video recording is in progress.

ACSstb-RemoteReq-06 – At the request of the ACS, an STB is required to perform a frequency scan.

ACSstb-RemoteReq-07 – At the request of the ACS, an STB is required to send the ACS RF log which indicates conditions of RF signal reception.

ACSstb-RemoteReq-08 – The ACS is required to be able to send the STB a request message to start measurement along with measurement interval and time to end measurement. The ACS is required to be able to send STB messages to stop measurement.

7.4 Firmware/Software upgrade

ACSstb-FirmUpReq-01 – An STB is required to have a function to download firmware and software that are stored in the ACS. The function is automatically and/or manually conducted. In the case of manual operation, it may need the user’s intervention to confirm the operation.

ACSstb-FirmUpReq-02 – At the request of the ACS, an STB is required to notify the ACS of its firmware and software version.

7.5 Audience measurement

ACSstb-AudienceReq-01 – At the request of the ACS, an STB is required to immediately or periodically send audience measurement data in store to the ACS.

ACSstb-AudienceReq-02 – At the request of the ACS, an STB is required to modify the measurement items to be sent to the ACS, e.g., information of which TV programme the user watched.

ACSstb-AudienceReq-03 – At the request of the ACS, an STB is required to modify the audience measurement parameters used for controlling the function, e.g., reporting interval.

ACSstb-AudienceReq-04 – The ACS is required to have manners by which the information collected by audience measurement function is used only by the cable operator to which the user subscribes. It is recommended to follow the local region's or country's regulation for personal data protection such as GDPR in the EU.

7.6 Remote diagnostics

ACSstb-RemoteDiagReq-01 – The ACS is required to support a remote diagnostics function. If any trouble occurs in the STB, remote trouble shooting can be performed.

ACSstb-RemoteDiagReq-02 – An STB is recommended to comprise basic diagnostic functions that may be remotely activated by the ACS. After activated, the STB will perform one or more diagnostic tests automatically, and the test results will be sent back to the ACS.

Bibliography

[b-JLabs SPEC-038] JLabs SPEC-038 Ver. 1.0 (2019), *Cable Industry ACS Technical Specification for Third Generation Cable STB.*

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	Tariff and accounting principles and international telecommunication/ICT economic and policy issues
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	**Cable networks and transmission of television, sound programme and other multimedia signals**
Series K	Protection against interference
Series L	Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling, and associated measurements and tests
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects, next-generation networks, Internet of Things and smart cities
Series Z	Languages and general software aspects for telecommunication systems

Published in Switzerland
Geneva, 2023