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SERIES F: NON-TELEPHONE TELECOMMUNICATION SERVICES

Multimedia services

Requirements for software-defined cameras

Recommendation ITU-T F.735.1

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Recommendation ITU-T F.735.1

Requirements for software-defined cameras

Summary

With the development of hardware and intelligent algorithms, various intelligent algorithms are developed for a large number of scenarios. In order to meet the various scenarios and requirements, cameras supporting algorithms on-demand deployment and online upgrade without service interruption are needed. A software-defined camera is a kind of intelligent premises unit (IPU), see Recommendation ITU-T F.743.1, which provides a technical approach to decoupling hardware and software and to support algorithms on-demand deployment, online upgrade without service interruption and continuous online learning to adapt to various scenarios. This Recommendation defines the typical scenarios, functional architecture and requirements of such software-defined cameras.

Recommendation ITU-T F.735.1 can facilitate a cooperation between camera manufacturers, customers and intelligent algorithm providers. The aim is to define the basic requirements and functional architecture for software-defined cameras.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T F.735.1	2020-08-13	16	11.1002/1000/14323

Keywords

Software-defined camera.

* 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.

FOREWORD

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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.

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

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As of the date of approval of this Recommendation, ITU had not 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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1 Scope

Currently, with the development of hardware and intelligent algorithms, various intelligent algorithms are developed for a large number of scenarios. In order to meet the various scenarios and requirements, cameras supporting algorithms on-demand deployment and online upgrade without service interruption are needed. A software-defined camera is a kind of intelligent premises unit (IPU), see [ITU-T F.743.1], which provides a technical approach to decoupling hardware and software and to support algorithms on-demand deployment, online upgrade without service interruption and continuous online learning to adapt to various scenarios. This Recommendation defines the typical scenarios, functional architecture and requirements of such software-defined cameras.

The scope of this Recommendation includes:

1) typical scenarios of software-defined cameras;
2) the functional architecture of software-defined cameras;
3) the requirements of software-defined cameras.

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 F.743.1] Recommendation ITU-T F.743.1 (2015), *Requirements for intelligent visual surveillance*.

[ITU-T H.626] Recommendation ITU-T H.626V2 (2019), *Architectural requirements for visual surveillance*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 traffic/pedestrian flow analysis [ITU-T F.743.1]: Motion analysis and feature classification of the video of moving target(s) within the specified single or multiple video monitoring area. The pedestrian flow data can be detected accurately.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 human body attribute extraction: Detection of the human body in video and extraction of its characteristics. These characteristics may include gender, age, clothes type, clothes colour, hairstyle and backpack, etc.

3.2.2 software-defined camera: A software-defined camera is a kind of IPU (see [ITU-T F.743.1]), which provides a technical approach to decoupling hardware and software and to support algorithms' on-demand deployment, online upgrade without service interruption and continuous self-adaptive learning to adapt to various scenarios.

3.2.3 vehicle recognition: Detection of the car in video and extraction of its characteristics. These characteristics may include brand, type, colour, etc.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AI Artificial Intelligence

API Application Programme Interface

APP Application

IPU Intelligent Premises Unit

ISP Image Signal Processing

PIV Premises Intelligent Video

PU Premises Unit

SDC Software-Defined Camera

5 Conventions

In this Recommendation:

The keywords "is required to" and "shall" 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 needs not be present to claim conformance.

The keywords "can optionally" and "may" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are 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.

6 Typical scenarios

This clause describes typical scenario examples illustrating the definition and work mechanism of software-defined cameras (SDCs).

6.1 Algorithms on-demand deployment and online upgrade

Software-defined cameras can support various scenarios through multi-algorithms on-demand deployment and upgrade. In the traditional surveillance systems, if the administrator wants to add a new feature or upgrade an algorithm, they have to restart the camera system and stop the surveillance service. In SDC systems, the administrator can deploy new algorithms through sending a deployment or upgrade command to software-defined cameras, then these cameras will apply this new feature without the system restarting and other service interruption.

6.2 Multi-algorithms parallel computing

The SDC supports multi-algorithm parallel computing, which means the camera can run multiple algorithms simultaneously, i.e., vehicle recognition, traffic/pedestrian flow analysis, human body attribute extraction, etc. The combination of multi-algorithms can perform as a specific mode. Users can switch between different modes to adapt different scenarios.

6.3 Online learning ability

The SDC supports continuous online learning. The SDC can automatically collect, clean and label the video or image data captured in the actual scene as a training set. It then use this training set to train the original training model which is already embedded internally, and adjusts the parameters of the model to complete final optimization of the model, making the learning model more suitable for the actual scene, as well as improving the accuracy of the intelligent analysis result.

7 Functional architecture

Figure 7-1 shows the overall functional architecture of an SDC. This architecture contains three layers, the SDC hardware layer, the SDC OS layer and the application layer. The descriptions of the three layers are as follows. The application here is related to the software which is used in the camera to complete video business and intelligent analysis.

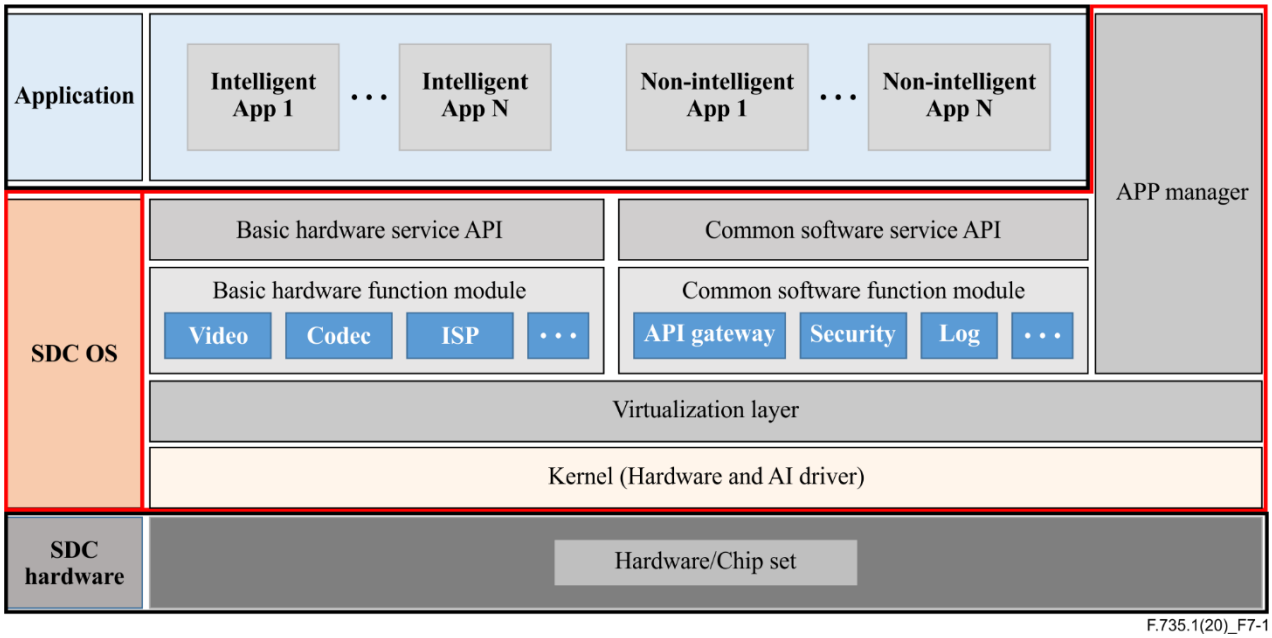

Figure 7-1 – Functional architecture of SDC

SDC hardware layer: This layer provides the corresponding hardware resource and AI chips for the upper layer.

SDC OS layer: This layer is composed of the basic hardware service API, the common software service API, the common software function module, the basic hardware function module, the virtualization layer, the APP manager and the kernel. The description of each module is as follows.

The kernel is the driver for hardware and AI chips.

The basic hardware function module is a function module for supporting the basic hardware capabilities of a camera which contains video, ISP, crypto, codec, PTZ, etc.

The basic hardware service API is the service API of the basic hardware function module.

The common software function module is used to provide the common software capabilities of a camera which include API gateway interface, event management, security, log, etc.

The common software service API is used to provide service interfaces and works as an API gateway for the camera; all the result intelligent APPs are provided through this common software service API.

The APP manager is a container manager which supports APP life cycle management, installation, activation, deactivation, uninstallation, upgrade, license management, etc.

The virtualization layer is used to complete the APP resources isolation and support the online upgrade and deployment without any service interruption; the major technology used here is the container technology.

The application layer is composed of intelligent APPs and non-intelligent APPs. The intelligent APPs include APPs such as face recognition, license plate recognition, etc., the non-intelligent APPs could be APPs for video streaming, transforming, etc.

8 Requirements for software-defined camera

The SDC is a kind of IPU; there are two types of requirement for an IPU (refer to clause 6 in [ITU-T F.743.1]), one is the requirement of the premises unit (PU) (refer to clause 6.2.8 in [ITU-T H.626V2]) including video/audio acquisition, image snapshot, recording/playback, event and alarm, PTZ control, etc. The other one is the requirements of PIV which can be referred to clause 6 in [ITU-T F.743.1]. This clause focuses on those requirements which belong to software-defined technology of cameras, and not those requirements which belong to the IPU.

8.1 User requirements

USR-001: The SDC is required to support users to view the information of the deployed applications, including name, version, status, license and other information of the application.

USR-002: The SDC is required to support users to manage applications, including installation, activation, deactivation, upgrade and uninstallation of the application in the SDC.

8.2 Service requirements

SRV-001: The SDC is required to support applications on-demand deployment and online upgrade without service interruption.

SRV-002: The SDC is required to support the life cycle management of applications, including installation, uninstallation, and activation, deactivation, upgrade and license management.

SRV-003: The SDC is required to support APP license verification and algorithm model file encryption to protect the intellectual property of the APP.

SRV-004: The SDC is recommended to support sharing intelligent analysis services with other PUs. In order to complete this service sharing, the SDC shall support video acquisition from other PUs, decoding the video, completing the intelligent analysis and sending the analysis results to the CU.

SRV-005: The SDC is recommended to embed a training model inside, and support automatic collection, cleaning and labelling the video or image data captured in the actual scene as a training set, and using these training sets to train the model and adjust the model parameter to complete the final optimization of the model.

Bibliography

[b-ITU-T H.Sup.1] Supplement 1 to the ITU-T H-series Recommendations (1999), *Application profile – Sign language and lip-reading real-time conversation using low bit rate video communication*.

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