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Recommendation

ITU-T H.626.6 (02/2024)

SERIES H: Audiovisual and multimedia systems

Broadband, triple-play and advanced multimedia services – Advanced multimedia services and applications

Architecture for big data application in video surveillance systems

ITU-T H-SERIES RECOMMENDATIONS

Audiovisual and multimedia systems

CHARACTERISTICS OF VISUAL TELEPHONE SYSTEMS	H.100-H.199
INFRASTRUCTURE OF AUDIOVISUAL SERVICES	H.200-H.499
MOBILITY AND COLLABORATION PROCEDURES	H.500-H.549
VEHICULAR GATEWAYS AND INTELLIGENT TRANSPORTATION SYSTEMS (ITS)	H.550-H.599
BROADBAND, TRIPLE-PLAY AND ADVANCED MULTIMEDIA SERVICES	H.600-H.699
Broadband multimedia services over VDSL	H.610-H.619
Advanced multimedia services and applications	**H.620-H.629**
Content delivery and ubiquitous sensor network applications	H.640-H.649
IPTV MULTIMEDIA SERVICES AND APPLICATIONS FOR IPTV	H.700-H.799
E-HEALTH MULTIMEDIA SYSTEMS, SERVICES AND APPLICATIONS	H.800-H.899

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

Recommendation ITU-T H.626.6

Architecture for big data application in video surveillance systems

Summary

Recommendation ITU-T H.626.6 defines an architecture for big data application in video surveillance systems, including the functional architecture and reference points. As the amount of video data is growing in video surveillance systems, a suitable architecture is needed to support the requirements for big data application in video surveillance systems to deal with the structured and unstructured data, and to enhance the efficiency of huge data retrieval and data mining across time and space range. This Recommendation is based on Recommendation ITU-T F.743.7, *Requirements for big data-enhanced visual surveillance services*.

History [*]

Edition	Recommendation	Approval	Study Group	Unique ID
1.0	ITU-T H.626.6	2024-02-13	16	11.1002/1000/15848

Keywords

Architecture, big data, video surveillance system.

[*] 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.

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Table of Contents

Recommendation ITU-T H.626.6

Architecture for big data application in video surveillance systems

1 Scope

This Recommendation specifies the functional architecture and reference points for big data application in video surveillance systems (VSS).

The scope of this Recommendation includes:

– Functional architecture for big data application in video surveillance systems;

– Reference points for big data application in video surveillance systems.

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] Recommendation ITU-T F.743 (V2) (2019), *Requirements and service description for video surveillance.*

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

[ITU-T F.743.7] Recommendation ITU-T F.743.7 (2019), *Requirements for big data-enhanced visual surveillance services.*

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

[ITU-T H.626.5] Recommendation ITU-T H.626.5 (V2) (2022), *Architecture for intelligent video surveillance systems.*

[ITU-T L.1390] Recommendation ITU-T L.1390 (2022), *Energy saving technologies and best practices for 5G radio access network (RAN) equipment.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 application [b-ITU-T Y.101]: A structured set of capabilities, which provide value-added functionality supported by one or more services.

3.1.2 big data [ITU-T L.1390]: A term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day basis. Big data can be analysed for insights that lead to better decisions and strategic business moves.

3.1.3 central control server [b-ITU-T H.626.3]: A device located at the central part of the visual surveillance system. It is used for centralized system management, service operation management and access control.

NOTE – The centre control server (CCS) consists of a centre management unit and a service-control unit.

3.1.4 customer unit [ITU-T H.626]: A device located at the customer part of a video surveillance system and used to present multimedia information (such as audio, video, image, alarm signal, etc.) to the end user.

3.1.5 functional architecture [b-ITU-T Y.2012]: A set of functional entities and the reference points between them used to describe the structure of an NGN. These functional entities are separated by reference points, and thus, they define the distribution of functions.

3.1.6 functional entity [b-ITU-T Y.2012]: An entity that comprises an indivisible set of specific functions. Functional entities are logical concepts, while groupings of functional entities are used to describe practical, and physical implementations.

3.1.7 interface [b-ITU-T Y.101]: A shared boundary between two functional units.

NOTE – An interface is defined by various characteristics pertaining to the functions, physical interconnections, signal exchanges, and other characteristics as appropriate.

3.1.8 media [b-ITU-T Y.101]: Plural of medium.

3.1.9 media server [ITU-T H.626]: A device located at the centre part of a video surveillance system. It is used to forward real-time media stream as well as store, retrieve and replay historical media stream. The media server (MS) receives the media stream from the premises unit or other media server and forwards the media stream to another customer unit or media server. It consists of a media distribution unit and a media storage unit.

3.1.10 premises unit [ITU-T H.626]: A device located at the remote part of a video surveillance system and used to capture multimedia information (such as audio, video, image, alarm signal, etc.) from a surveilled object.

3.1.11 reference point [b-ITU-T Y.2012]: A conceptual point at the conjunction of two non-overlapping functional entities that can be used to identify the type of information passing between these functional entities.

3.1.12 service [b-ITU-T Y.101]: A structured set of capabilities intended to support applications.

3.1.13 video surveillance system (VSS) [ITU-T F.743]: A telecommunication system focusing on video (but including audio) application technology, which is used to remotely capture multimedia (such as audio, video, image, alarm signals, etc.) and present them to the end user in a friendly manner, based on a managed broadband network with quality, security and reliability ensured.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AEF Analysis Evaluation Function

AMF Analysis Management Function

APP Application

ASCF Analysis Service Control Function

BDAU Big Data Application Unit

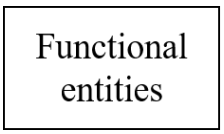
CCS Centre Control Server

CFBDA Console Function of Big Data Application

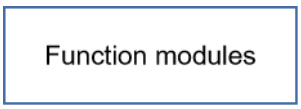
CSF	Computing Service Function
CU	Customer Unit
CMU	Centre Management Unit
DMAF	Data Mining and Analysis Function
DSS	Data Storage and Service
DSU	Data Storage Unit
ISU	Information Storage Unit
IVS	Intelligent Visual Surveillance
MDU	Media Distribution Unit
MS	Media Server
MSU	Media Storage Unit
PU	Premises Unit
VAEU	Visual Analysis Engine Unit
VSAF	Video Streaming Access Function
VSBD	Big Data application in Video Surveillance systems
VSS	Video Surveillance System

5 Conventions

Functional entities: In the context of VSBD architecture, "functional entities" are defined as a collection of functionalities. It is represented by the following symbol:



Function modules: In the context of VSBD architecture, "function modules" are defined as groups of functionalities that has not been further subdivided at the level of detail described in this Recommendation. It is represented by the following symbol:



NOTE – In the future, other groups or other Recommendations may possibly further subdivide these function modules.

6 Functional architecture for big data application in VSS(s)

This clause describes the functional architecture for big data application in video surveillance systems (VSBD) and functional entities.

Big data is defined in [ITU-T L.1390], and big data application are also analysed for insights that lead to better decisions and strategic business moves from the amount of data. The scenarios of VSBD are defined in [ITU-T F.743.7], they are:

– Intelligent video retrieval. For example, VSBD can use characteristic information such as licence plate, vehicle type, colour, brand type or body feature of the target vehicle as input, to retrieve similar objects in multiple videos with the trajectories displayed to users.

– Intelligent event detection. For example, VSBD can detect a fire disaster by analysing the related real-time videos as well as sensing data from smoke detectors and temperature sensors in areas of concern to the users.

– Status prediction. For example, according to the data collected by cameras, VSBD can analyse the rules and forecast future traffic flow in order to achieve efficient traffic control.

6.1 Functional architecture in VSBD

The system's functional architecture is illustrated in Figure 6-1.

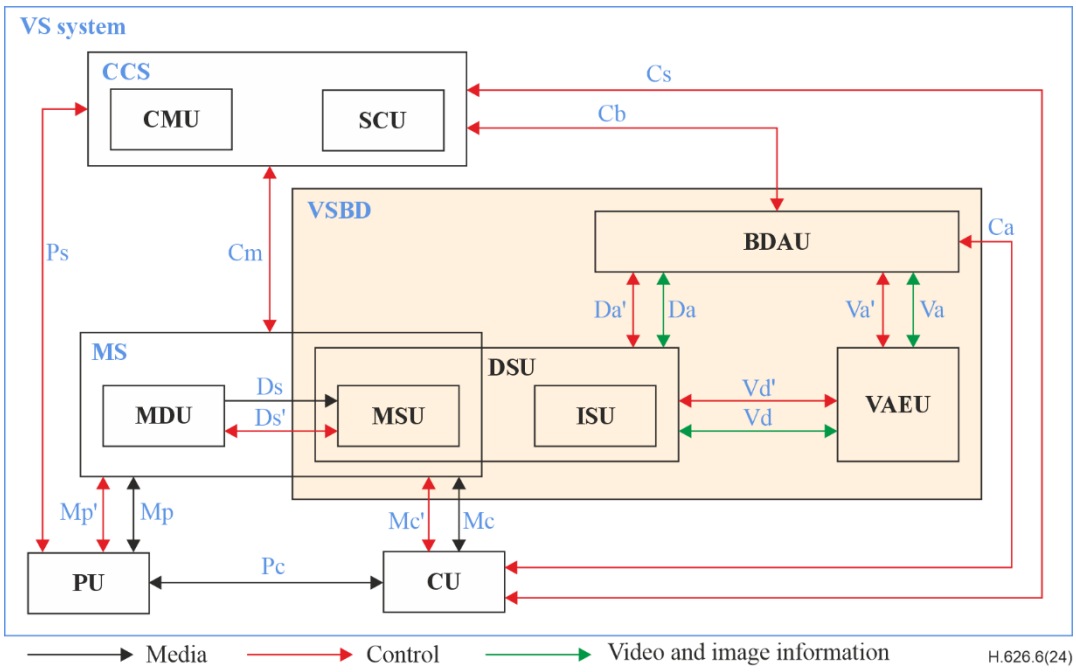


Figure 6-1 – Functional architecture

The VSBD is an end-to-end system without a customer unit focusing on a large amount of video (but including audio) data, which is to collect, store, process, analyse, apply, and display the video data. It consists of a big data application unit (BDAU), data storage unit (DSU) and visual analysis engine unit (VAEU).

The VSBD is different from the intelligent visual surveillance (IVS) system and the application (APP) defined in [ITU-T F.743.1] and the data storage and service (DSS) defined in [ITU-T H.626.5].

The centre management unit (CMU), service-control unit (SCU), media distribution unit (MDU), media storage unit (MSU), premises unit (PU) and customer unit (CU) are defined in [ITU-T H.626]. And the rest in Figure 6-1 is described in clause 6.2 and the reference points in clause 7.

6.2 Functional entities

This clause defines the functional entities for VSBD.

6.2.1 Big data application unit

The BDAU is the functional entity of application aspects. It consists of a video streaming access function (VSAF), console function of big data application (CFBDA) and a data mining and analysis function (DMAF).

The main tasks of BDAU are application selection, application operation, application presentation, application access such as video streaming access function, portal service presentation, data mining and analysis service selection.

Figure 6-2 shows the function modules of the BDAU.

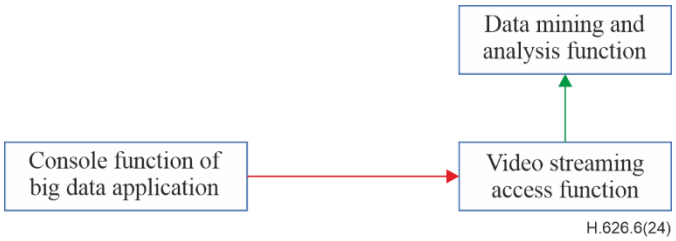


Figure 6-2 – Function modules of BDAU

6.2.1.1 Video streaming access function

VSAF is a functional module for access and re-transmission.

The main tasks of VSAF are to access data storage and re-transmit analysis data. For example, VSAF can be used to get the original video data according to monitoring time. VSAF can also be used to decode the original video data to get the required video data and send the video frames to the video analysis engine for analysis.

6.2.1.2 Console function of big data application

CFBDA is the portal of VSBD.

The main task of the CFBDA is to interact with the CU. The CFBDA provides the interface to operate and control the VSBD. Through the CFBDA, the authorized end user can, e.g., manage alarm task, video enrichment task, data retrieval and analysis task, subject research-prediction task, etc.

6.2.1.3 Data mining and analysis function

DMAF is the display carrier for the results of big data analysis.

The main tasks of DMAF are to play and display the result and information of data mining and analysis such as video enrichment, real-time deploy-control and alarming, data retrieval and analysis and status prediction.

6.2.2 Visual analysis engine unit

VAEU is the functional entity for visual analysis aspects. It consists of an analysis service control function (ASCF), analysis management function (AMF), computing service function (CSF) and analysis evaluation function (AEF).

The main tasks of VAEU are to analyse the video data and output the analysis results.

Figure 6-3 shows the function modules of the VAEU.

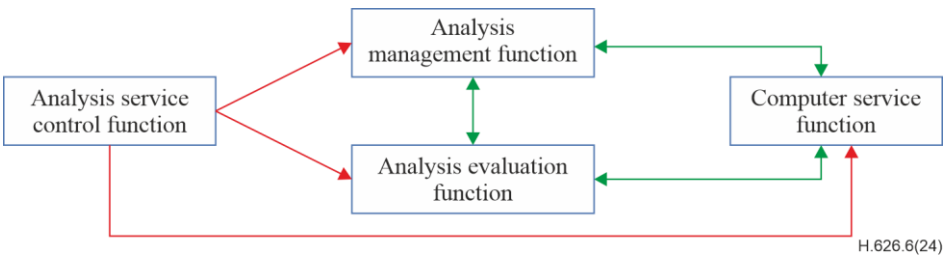


Figure 6-3 – Function modules of VAEU

6.2.2.1 Analysis service control function

ASCF is the functional module for service-control aspects.

The main tasks of the ASCF are service description, service registration, service access, service selection, service scheduling, service monitoring, service tracking and service management.

6.2.2.2 Analysis management function

AMF is the functional module for video or image process aspects.

The main tasks of the AMF are to identify specific objects automatically and output the analysis results to the BDAU, recognize information including triggered events and acquired data, load or unload one or more intelligent analysis algorithms on the CSF according to the different requirements and evaluation from the AEF, send capability lists, statuses and analysis results to the AEF.

6.2.2.3 Computing service function

CSF is the functional module for computing aspects.

The main task of the CSF is to provide calculation ability to the AMF and AEF according to the different requirements.

6.2.2.4 Analysis evaluation function

AEF is the functional module for evaluating aspects to improve the accuracy of the visual analysis.

The main tasks of the AEF are to evaluate the quality and performance of capabilities and send the report to the AMF. According to the different requirements, the AEF evaluates analysis results by checking the statuses of capability lists and choosing the one which has the best performance capability.

6.2.3 Data storage function

DSF is the functional entity for data storage aspects. It consists of MSU and an information storage unit (ISU). MSU is defined in [ITU-T H.626]. ISU is the function module to store, index, download and provide serving of video and image information from the VAEU.

The main tasks of the DSF are to store data, index data, download data and provide data serving.

7 Reference points

This clause defines reference points. The reference points Cm, Cs, Ps, Ds, Ds', Mp, Mp', Mc, Mc' and Pc are defined in [ITU-T H.626].

7.1 Reference point Va/Va'

Reference points Va and Va' are between the BDAU and the VAEU.

Va is used to report the results of the intelligent analysis task from the VAEU to the BDAU.

Va' is used to send the user request of a big data analysis task (such as search target by image, search target by attribute, etc.) from the BDAU to the VAEU, report the status of the big data analysis task from the VAEU to the BDAU, and control the big data analysis task from the VAEU to the BDAU.

7.2 Reference point Vd/Vd'

Reference points Vd and Vd' are between the VAEU and the DSU.

Vd is used to transmit the authorized video and image data from the DSU to the VAEU when the data stored in the DSU is required to be accessed by the BDAU's users and transmit video and image information from the VAEU to the DSU when the analysed information is required to be collected to the DSU.

Vd' is used to send data access request from the VEAU to the DSU, and support data operations like information query, etc., based on the request from the VEAU to the DSU.

7.3 Reference point Da/Da'

Reference points Da and Da' are between the DSU and the BDAU.

Da is used to transmit the authorized video and image information from the DSU to the BDAU when the data stored in the DSS is required to be accessed by the BDAU's users and transmit video and image information from the BDAU to the DSU when the information captured by the BDAU is required to be collected to the DSU.

Da' is used to send video and image information access request from the BDAU to the DSU such as information query or subscription and so on.

7.4 Reference point Cb

Reference point Cb lies between the centre control server (CCS) and the BDAU. It is used to send the user authentication request from the BDAU to the CMU and return the authentication result.

7.5 Reference point Ca

Reference point Ca lies between the CU and the BDAU. It is used by the CU to select, search, play, download and install applications.

Bibliography

[b-ITU-T H.626.3] Recommendation ITU-T H.626.3 (2018), *Architecture for visual surveillance system interworking.*

[b-ITU-T Y.101] Recommendation ITU-T Y.101 (2000), *Global Information Infrastructure terminology: Terms and definitions.*

[b-ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks.*

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Series D	Tariff and accounting principles and international telecommunication/ICT economic and policy issues
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