International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

F.743.16

(03/2022)

SERIES F: NON-TELEPHONE TELECOMMUNICATION SERVICES

Multimedia services

Requirements for communication resource management in intelligent visual surveillance systems

Recommendation ITU-T F.743.16

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Recommendation ITU-T F.743.16

Requirements for communication resource management in intelligent visual surveillance systems

Summary

Recommendation ITU-T F.743.16 defines the architecture and specifies the requirements for communication resource management in intelligent visual surveillance (IVS) systems, including the requirements of communication resource monitoring, resource provisioning and resource scheduling. Communication resource management in the IVS system aims to make rational use of communication resources, so that it can complete the tasks which are generated by the IVS system efficiently.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T F.743.16	2022-03-16	16	11.1002/1000/14957

Keywords

Communication resource management, intelligent visual surveillance.

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* 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.

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Requirements for communication resource management in intelligent visual surveillance systems

1 Scope

This Recommendation specifies the requirements for communication resource management in IVS systems, including communication resource monitoring, communication resource provisioning and communication resource scheduling. Computing resource management and storage resource management in the IVS systems are out of the scope of this Recommendation.

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

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 customer unit [ITU-T H.626 (V2)]: A device located at the customer part of a visual surveillance system and used to present multimedia information (such as audio, video, image, alarm signal, etc.) to the end user.

3.1.2 intelligent visual surveillance system [ITU-T F.743.1]: A system that can automatically identify specific objects, behaviours, or attributes in video signals. They extract data from the video signals, which are then transmitted or archived so that the visual surveillance system can act accordingly.

3.1.3 video surveillance system [ITU-T H.626 (V2)]: A telecommunication service focusing on video (but including audio) application technology, which is used to remotely capture multimedia (such as audio, video, image, alarm signal, etc.) and present them to the end user in a user-friendly manner, based on a managed broadband network with ensured quality, security and reliability.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 communication resource information table: A table that is used to store all the available communication resources of the IVS system.

3.2.2 communication resource management: The monitoring, provisioning and scheduling of communication resources, which can complete the tasks of the IVS system, such as intrusion detection and portrait recognition.

3.2.3 communication resource monitoring: A module that is used to monitor path status and collect the resources usages by measuring tools in the IVS system.

3.2.4 communication resource provisioning: A module that provides the demanded communication resources for the new tasks to be performed according to tasks' requirements, such as QoS.

3.2.5 communication resource provisioning agent: An agent which performs communication resource discovery and selects suitable communication resources based on the tasks' requirements, such as QoS.

3.2.6 communication resource scheduling: A module that is used for dynamically scheduling communication resources.

3.2.7 traffic classification: An automatic process that classifies data flow into multiple categories based on various parameters (such as port numbers or protocols).

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CRIT Communication Resource Information Table

CRM Communication Resource Management

CRMT Communication Resource Monitoring

CRP Communication Resource Provisioning

CRPA Communication Resource Provisioning Agent

CRS Communication Resource Scheduling

CU Customer Unit

IVS Intelligent Visual Surveillance

5 Conventions

In this Recommendation:

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

– The keywords "can optionally" and "may" indicate an optional requirement that 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 Architecture of the communication resource management in an IVS system

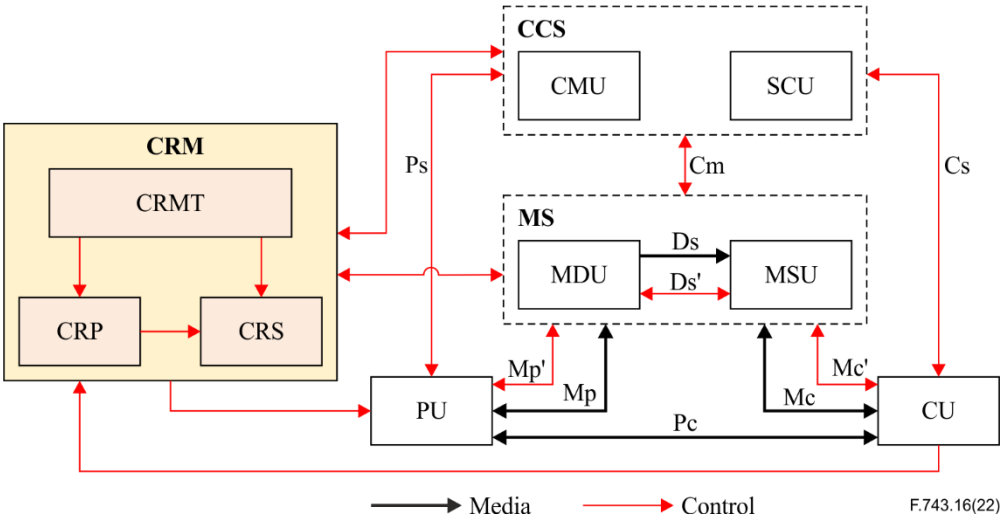

Figure 6-1 – The architecture of communication resource management in an IVS system

Figure 6-1 shows the architecture of communication resource management (CRM) in the IVS system, based on the functional architecture of the video surveillance system in [ITU-T H.626 (V2)]. This framework adds three new modules, including the communication resource monitoring (CRMT) module, communication resource provisioning (CRP) module and communication resource scheduling (CRS) module.

The CRMT module is the basis of efficient data transmission. The CRMT module works on all the communication paths, and is in charge of monitoring the changes in the communication path state in real time, including the congestion status, bandwidth occupancy and the traffic classification transmitted in the paths between the IVS system and the devices. The CRMT module obtains the monitoring data from the MS module of the IVS system. So that the CRMT module can quantify the usage of the communication resources in real time, and guide the provisioning and scheduling of communication resources.

The CRP module offers three functions, including communication resource discovery, communication path selection and communication resource providing. The CRP module updates the communication resources status of the IVS system and reserves the communication resources for new tasks according to the current communication resources status and the requirements of the tasks. The CRP module consists of communication resource information table (CRIT) and communication resource provisioning agent (CRPA). CRIT is a table that stores all the available communication resources, such as the amount of usable bandwidth on a certain path. Customer unit (CU) can interact with CRPA and submit the QoS requirements of the workload. Based on the requirements (such as QoS) and the communication resource information delivered by the CRIT, CRPA checks the available communication resources of the IVS system. It provisions the demanded communication resources for the new tasks to be performed only if the desired communication resources are available in the IVS system.

After provisioning the communication resources effectively, the data will be transmitted in the selected path. During transmission, the communication resources may not be able to meet the task requirements, for example, a congested path is detected by the communication resource monitoring module, or the problem of long end-to-end delay is reported by the external devices. Then the CRS module will schedule the appropriate communication resources for the task in time, so that the tasks can utilize the communication resources effectively. The CRS module comprises two functions: bandwidth adaptation and path reselection.

7 Requirements of communication resources monitoring in an IVS system

7.1 Requirements of path congestion status monitoring

PCSM-01: CRMT is required to monitor the number of bits and packets of all the paths of the IVS system in real time.

PCSM-02: CRMT is required to obtain the delay of each task of the IVS system according to the monitored information.

PCSM-03: CRMT is required to analyse which flow stresses certain routers or paths according to the monitored information of all the paths of the IVS system.

PCSM-04: CRMT is required to determine which path is congested and the congestion state of the path according to the obtained transmission delay and traffic.

PCSM-05: CRMT is recommended to send an alert message to notify the communication resource provisioning module and the communication resource scheduling module when a congested path is detected.

7.2 Requirements of path bandwidth occupancy monitoring

PBOM-01: It is required to monitor the bandwidth usage of all paths of the IVS system so that the IVS system can compute path bandwidth occupancy of all paths.

PBOM-02: Monitoring path bandwidth occupancy is required to use the tools which can measure the bandwidth usage of the path.

7.3 Requirements of path traffic monitoring

PTM-01: It is required to get the relevant parameters of the traffic of the paths in the IVS system, such as port number, QoS, etc.

PTM-02: It is required to determine the traffic type according to the relevant parameters of the traffic of the paths in the IVS system. For example, the IVS system can divide traffic into delay-sensitive traffic and non-delay-sensitive traffic according to the QoS requirements of the traffic, so that the IVS system can obtain the dominant traffic type and analyse the traffic situation.

PTM-03: Different types of traffic have different requirements, so it is required to mark the identified traffic type.

PTM-04: The IVS system is required to deploy a communication resource allocation policy for the different traffic according to the traffic types. For example, the IVS system can allocate different communication resources for different traffics.

8 Requirements of communication resource provisioning in an IVS system

8.1 Requirements of communication resource discovery

CRD-01: It is required to obtain information about the available communication resources of the IVS system by using the communication resource monitoring.

CRD-02: It is required to store all the available communication resources of the IVS system in a table. For example, the types (such as video, audio, etc.) and bandwidth occupancy of each traffic are recorded in the table.

CRD-03: It is required to update the communication resource information table regularly because the communication resources of the IVS system are dynamic.

8.2 Requirements of communication path selection

CPS-01: It is required to select the communication path for the new tasks of the IVS system.

CPS-02: It is required to submit the related requirements (such as monitoring queries, alarms, etc.) of the tasks to CRPA.

CPS-03: The IVS system may serve multiple tasks simultaneously, so CRPA will receive tasks submitted by multiple users at the same time.

CPS-04: According to the relevant requirements of different tasks and the real-time status of the communication resources in the IVS system, it is required to provide appropriate communication resources for different tasks.

CPS-05: In the IVS system, there are multiple hops during the transmission process of a task, it is required to select the communication path of the next hop for the task according to the current path status and the task's requirements, to achieve the QoS of different tasks.

CPS-06: It is required to record the selected path for different tasks.

8.3 Requirements of bandwidth reservation

BR-01: In order to ensure that the data can be successfully transmitted in the path, adequate bandwidth is required to be reserved for the tasks to be processed in the IVS system.

BR-02: The communication path of the data transmission may contain multiple hops, it is required to reserve bandwidth for the task in each hop of the communication path.

BR-03: Two factors are required to be considered when determining the amount of bandwidth to be reserved for a task, including the bandwidth requirements of the task and the total bandwidth requirements of all tasks within the hop. For example, bandwidth is reserved for each task in proportion according to the bandwidth requirements of each task and the total bandwidth requirements of all data transmitted in the path.

9 Requirements of communication resource scheduling in an IVS system

9.1 Requirements of bandwidth adaptation in the original path

BA-01: Bandwidth adaptation in the original path as an efficient way is required to utilize communication resources efficiently in the IVS system.

BA-02: During data transmission, the reserved bandwidth in the communication resource provisioning of some hops in the path may not be able to meet the task requirements. When this problem occurs, bandwidth is required to be adjusted and the free bandwidth in the hop are required to be considered.

BA-03: If there is idle bandwidth reserved for other tasks, that is, part of the reserved bandwidth is not used, and the idle bandwidth is recommended to be temporarily adjusted to the task with insufficient reserved bandwidth.

BA-04: Bandwidth adaptation in the original path is required to reallocate bandwidth for the tasks to meet the requirements of transmission.

9.2 Requirements of path reselection

PR-01: It is required to reselect the path if the data transmitted in the original path cannot meet its QoS requirements, and more bandwidth cannot be scheduled through bandwidth adaptation in the original path.

PR-02: Path reselection is required to reselect some hops of the path or the reselection of the whole path.

PR-03: When reselecting a hop of a path, it is required to consider whether there is an alternative hop between two points. The hop can be replaced if there is an alternative hop and the bandwidth of the alternative hop can meet the transmission requirements of the task.

PR-04: The whole path is required to be reselected when the single-hop replacement cannot be carried out.

PR-05: A new path with sufficient bandwidth is required to be selected to meet the requirements.

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Printed in Switzerland
Geneva, 2022