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SERIES M: TELECOMMUNICATION MANAGEMENT,
INCLUDING TMN AND NETWORK MAINTENANCE

Telecommunications management network

**Requirements for quality of experience
management of video used for surveillance**

Recommendation ITU-T M.3365

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International transmission systems	M.300–M.559
International telephone circuits	M.560–M.759
Common channel signalling systems	M.760–M.799
International telegraph systems and phototelegraph transmission	M.800–M.899
International leased group and supergroup links	M.900–M.999
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International data transmission systems	M.1300–M.1399
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Telecommunications management network	M.3000–M.3599
Integrated services digital networks	M.3600–M.3999
Common channel signalling systems	M.4000–M.4999

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Recommendation ITU-T M.3365

Requirements for quality of experience management of video used for surveillance

Summary

Recommendation ITU-T M.3365, for video used for surveillance, specifies requirements for quality of experience (QoE) management, including that of resources, indicators, the evaluation activity configuration and evaluation records. Recommendation ITU-T M.3365 provides a scenario for a video quality evaluation system, which is a tool that implements its requirements. Recommendation ITU-T M.3365 also gives examples of video quality evaluation records for reference.

History

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Table of Contents

	Page
1 Scope	1
2 References.....	1
3 Definitions	1
3.1 Terms defined elsewhere	1
3.2 Terms defined in this Recommendation.....	1
4 Abbreviations and acronyms	2
5 Convention.....	2
6 Overview	2
7 Requirements for quality evaluation management of video	3
7.1 Requirements for management of video resource	3
7.2 Requirements for management of QoE indicators for video.....	3
7.3 Requirements for configuration management of QoE evaluation activity	3
7.4 Requirements for management of a QoE evaluation record	4
Appendix I – Video quality evaluation system scenarios	6
Appendix II – Examples of video quality evaluation records.....	7
Bibliography.....	8

Recommendation ITU-T M.3365

Requirements for quality of experience management of video used for surveillance

1 Scope

This Recommendation specifies, for video used for surveillance, requirements for quality of experience (QoE) management, including that of resources, indicators, the evaluation activity configuration and evaluation records.

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-R BT.500] Recommendation ITU-R BT.500-14 (2019), *Methodologies for the subjective assessment of the quality of television pictures*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 block distortion [b-ITU-T P.10]: Distortion of the image characterized by the appearance of an underlying block encoding structure. Also called tiling.

3.1.2 blurring [b-ITU-T P.10]: A global distortion over the entire image, characterized by reduced sharpness of edges and spatial detail.

3.1.3 colour errors [b-ITU-T P.10]: Distortion of all or a portion of the final image characterized by the appearance of unnatural or unexpected hues or saturation levels. These hues or saturation levels were not present in the original image.

3.1.4 jerkiness; jerky motion [b-ITU-T P.10]: Motion that was originally smooth and continuous is perceived as a series of distinct "snapshots".

3.1.5 quality of experience (QoE) [b-ITU-T P.915]: The degree of satisfaction of the user of an application or service. It results from the fulfilment of his or her expectations with respect to the utility or enjoyment of the application or service in the light of the user's personality and current state.

3.1.6 video surveillance system [b-ITU-T H.626]: A telecommunication service focusing on video (but including audio and image) 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 video quality evaluation system (VQES): A system that can analyse and evaluate the quality of experience of video used for surveillance.

3.2.2 video tag: A way of marking videos that belong to the same category, which facilitates their classification, querying, tracking and export.

NOTE – For example, tags can be classified according to type of video or field of view of observed objects that appear. However, because of jurisdictional variances in global privacy policy and regulations, tagging or classification, video based on personally identifiable information is not a component of this Recommendation.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

NORM	No Reference Metric
QoE	Quality of Experience
VQES	Video Quality Evaluation System

5 Convention

In this Recommendation:

The phrase "is recommended" indicates a requirement that is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformity.

6 Overview

With the continuous increase of video surveillance sites, the scale of video surveillance systems is increasing, and the application scenario is becoming more and more extensive.

Whether during real-time monitoring or video replay after the fact, video quality degradation has a serious impact on the effective use of information. However, traditional video surveillance systems are not efficient to help the operators to quickly identify a decline in quality of video when faced with a large number of cameras. So it is urgent to analyse requirements for the QoE management of video in a visual surveillance service.

For video collected and stored in a surveillance system, QoE indicators and requirements for QoE management are used to support automatic and intelligent analysis of quality. QoE indicators and computing methods can be decided by the service provider. Indicators applied to describe video quality from the user perspective can be used. Some QoE indicators, such as block distortion (clause 3.1.3), blurring (clause 3.1.4), colour errors (clause 3.1.5) and jerkiness (clause 3.1.6), are suitable.

Some Recommendations and projects have already proposed intelligent prediction algorithms based on QoE indicators, such as [b-ITU-T P.1203], [b-ITU-T P.1204] and the no reference metric (NORM) project (see [b-VQEG NORM]). For example, the NORM project uses weighted QoE indicators to predict the overall quality (mean opinion score). It specifies the range of different indicators, e.g., the range of blurring is from 0 to 70 and the normal range is from 0 to 5. By generating different values of indicators, the final video quality score is obtained. The methods in [ITU-R BT.500] can also be used to set threshold and range to compare with the actual value of these indicators. Suitable QoE indicators and computing methods can be chosen according to actual situation.

The requirements for QoE management of video in surveillance service cover resources, indicators, evaluation activity configuration and evaluation records. This Recommendation, which suggests functions that a VQES can achieve from the perspective of functional requirements, proposes requirements for QoE management of video. VQES is a specific system to achieve the functional requirements specified in clause 7.

Appendix I gives a scenario for a VQES, which is a tool that satisfies the requirements developed in this Recommendation. Appendix II gives examples of video quality evaluation records for reference.

7 Requirements for quality evaluation management of video

7.1 Requirements for management of video resource

To evaluate the QoE of video, it is recommended that video resources be retrieved and stored from video surveillance systems as a base firstly, and then quality evaluation management performed on them.

7.1.1 Requirements for management of video information

It is recommended that video information be managed by querying it and managing its tags.

- Querying video information: It is recommended that video information be queried, with additional support for fuzzy querying, by specific name and by specific tag name. It is recommended that videos be sorted by file name, tag name, creation time, file size and so on.
- Video tag management: It is recommended that the addition, deletion and modification of tag information related to a video be supported.

7.1.2 Requirements for management of tag category

It is recommended that the creation, editing and deletion of tags be supported.

- Query tag: Query tag information by tag name. It is recommended that fuzzy querying with a tag name be supported.
- Add tag: It is recommended that the addition of tag information be supported.
- Delete tag: It is recommended that the deletion of tag information be supported.
- Edit tag: It is recommended that the modification of tag information be supported.
- View tags: It is recommended that the viewing of all video tags stored in the system be supported.

7.2 Requirements for management of QoE indicators for video

It is recommended that evaluation indicators be selected and abnormal thresholds set for each evaluation indicator.

- Query evaluation indicator: Query the information of an indicator by name, including the definition, calculation method and default exception threshold.
- Select evaluation indicator: It is recommended that operation personnel select several evaluation indicators provided by the system for a video or a set of videos with specific tag.
- Delete evaluation indicator: It is recommended that deletion of evaluation indicators be supported.
- Change exception threshold of evaluation indicator: For each evaluation indicator, it is recommended that operation personnel change the default abnormality threshold value according to requirements.
- Set evaluation configuration: The calculation method and configuration affect calculation accuracy, processing time and resource consumption. It is recommended that the configuration of evaluation method be supported for each indicator, including evaluation period and averaging algorithm, e.g., support for the evaluation of the quality of video every 10 frames and generation of the arithmetic mean score of all values as the final score.

7.3 Requirements for configuration management of QoE evaluation activity

It is recommended that management of information and evaluation activity status be supported.

7.3.1 Requirements for configuration management of QoE evaluation activity information

It is recommended that the management of QoE evaluation activities be supported.

- Query evaluation activity: It is recommended that operation personnel be supported to query the current evaluation activity list, including its name, content and priority.
- Add evaluation activity: After assigning evaluation indicators to a video or a set of videos with a specific tag, it is recommended that an evaluation activity be established and added to the video evaluation activity list.
- Delete evaluation activity: It is recommended that deletion of an evaluation activity from evaluation activity list be supported.
- Edit evaluation activity: It is recommended that modification of an evaluation activity, such as its priority, be supported.

7.3.2 Requirements for status management of QoE evaluation activity

It is recommended that the function of querying the execution status of all evaluation activities, such as whether they are completed or running, be supported.

- Query evaluation activity status: If operation personnel query the status of an evaluation activity, it is recommended that its name, priority and status (waiting, completed, suspended, running, cancelled, etc.) be listed.
- Perform evaluation activity: It is recommended that an evaluation activity be performed and its status changed from waiting to running.
- Suspend evaluation activity: It is recommended that operation personnel be supported to pause a running evaluation activity. If the evaluation activity is paused, the execution is temporarily suspended until operation personnel request its continuation.
- Continue evaluation activity: For suspended evaluation activity, it is recommended that it be resumed.
- Cancel evaluation activity: It is recommended that operation personnel be supported to cancel an evaluation activity that is running or paused.

7.4 Requirements for management of a QoE evaluation record

Video quality evaluation results are continuously updated according to the analysis results of each evaluation indicator. The video quality comprehensive score is judged according to the latest analysis results of each evaluation indicator of the video. If any of the evaluation indicators are abnormal, the video quality comprehensive score is abnormal. If the evaluation indicators are all normal, the video quality score is normal.

The operation personnel can view the latest analysis results and the latest comprehensive scores of each evaluation indicator on the video, and export the corresponding report.

7.4.1 Requirements for generation of a QoE evaluation record

It is recommended that QoE evaluation records be automatically generated, including evaluation time, score of each indicator and comprehensive scores.

7.4.2 Requirements for query of QoE evaluation results

The evaluation result includes comprehensive evaluation scores of video quality, video title, tag information, latest analysis time, number of normal indicators, names of normal indicators and their values, number of abnormal indicators, names of abnormal indicators and their values.

- Query evaluation results: It is recommended that the function of querying evaluation results of a video be supported. The operation personnel can search the evaluation result of a specific video according to the evaluation time, video name, video tag, etc.

- Export evaluation results: It is recommended that the video quality evaluation result be exported in a specified format.

7.4.3 Requirements for update and storage of a QoE evaluation record

The video can be re-evaluated with the same evaluation configuration to confirm the evaluation result, after which, it is recommended that the QoE evaluation record, including the latest evaluation time, score of each indicator, comprehensive scores and evaluation configuration, be updated.

7.4.4 Requirements for deletion of a QoE evaluation record

It is recommended that deletion of a QoE evaluation record, including the latest evaluation time, score of each indicator and comprehensive scores, be supported.

Appendix I

Video quality evaluation system scenarios

(This appendix does not form an integral part of this Recommendation.)

By using a video surveillance system, management can get effective image or sound information to record abnormal events in a timely manner. Whether during real-time monitoring or video replay after the fact, video quality degradation has a serious impact on the effective use of information. So it is urgent to establish a VQES to analyse and evaluate the QoE of video shown in a surveillance system. The VQES collects data specified in the requirements.

The VQES provides standardized video quality evaluation indicators and evaluation method, as well as supporting automatic analysis of QoE indicators of video. The application scenario of the VQES is shown in Figure I.1.

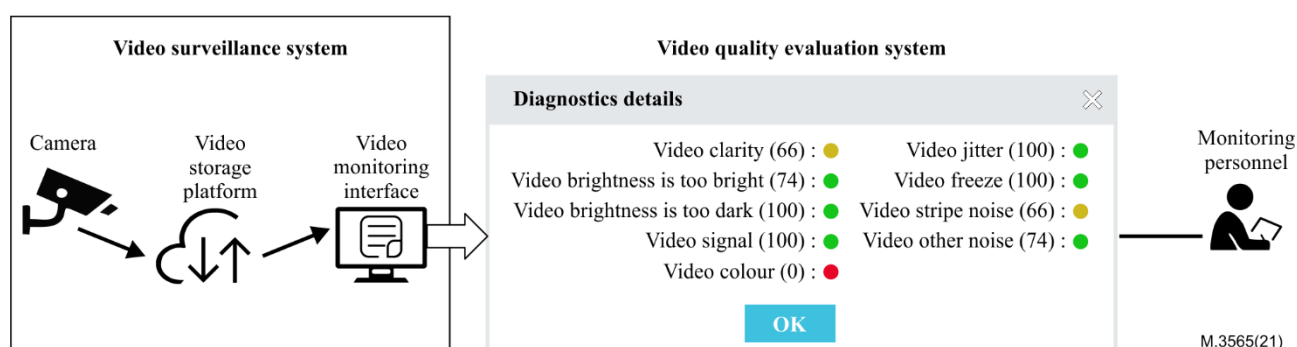


Figure I.1 – Scenario of VQES

In a video surveillance system, the camera collects video data on the field of view monitored, uploads the collected data to a monitoring platform and stores it in a video database. The VQES then extracts video data from the database of the video surveillance system and diagnoses the QoE of the video.

The VQES judges video quality by calculating relevant indicators. It evaluates the clarity, brightness, signal deficiency and other indicators on the video, and stores the diagnostic results in the database. If there is a problem with video quality, the VQES notifies the monitoring personnel about the abnormality. In this way, monitoring personnel need not watch the screen all the time and judge the quality of video in a subjective way. Compared to manual video monitoring, VQES liberates the labour force, reduces labour costs and improves the efficiency of operation. In addition, VQES improves the accuracy and efficiency of video QoE assessment compared to manual evaluation.

Appendix II

Examples of video quality evaluation records

(This appendix does not form an integral part of this Recommendation.)

This appendix gives examples of video quality evaluation records for reference, including tables for an evaluation environment record (Table II.1) and evaluation result record (Table II.2, which refers to the video quality indicators table in the NORM project).

Table II.1 – The evaluation environment record

Items	Description
Monitoring time	
Monitoring location	
Monitoring device type	
Monitoring device model	
Monitoring device size	
Monitoring distance	
Video display card manufacturer	
Video display card model	

Table II.2 – The evaluation result record

Evaluation parameters	Range of value	Normal range of value	Actual value
Block distortion	min. = 0, max. $\approx$ 100-200	From 0 to 5	
Blurring	min. = 0, max. $\approx$ 70	From 0 to 5	
Colour errors	min. = 0, max. $\approx$ 100-200	From 0 to 5	
Jerkiness	min. = 0, max. = 8	For the window with a length of 8 frames, typical value is around 0.125.	

Bibliography

- [b-ITU-T H.626] Recommendation ITU-T H.626 (2019), *Architectural requirements for visual surveillance system*.
- [b-ITU-T P.10] Recommendation ITU-T P.10/G.100 (2017), *Vocabulary for performance, quality of service and quality of experience*.
- [b-ITU-T P.915] Recommendation ITU-T P.915 (2016), *Subjective assessment methods for 3D video quality*.
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