

Recommendation

ITU-T F.743.28 (01/2025)

SERIES F: Non-telephone telecommunication services

Multimedia services

Functional framework and requirements for an intelligent inspection system based on cloud-edge-device collaboration in smart grids

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Recommendation ITU-T F.743.28

Functional framework and requirements for an intelligent inspection system based on cloud-edge-device collaboration in smart grids

Summary

An intelligent inspection system is helpful for assisting humans in inspection work, offering advantages such as high efficiency and low operation and maintenance (O&M) costs. It is widely used in scenarios such as the inspection of power stations, substations and transmission lines. However, there are challenges with the inspection data transmitted to the cloud, such as the huge volumes, high complexity, long storage cycles and high computing frequency. Additionally, many substations and transmission lines are located in remote areas, where network connections are often poor, and the ability to properly inspect in harsh environments needs to be taken into consideration. An intelligent inspection system based on cloud-edge-device collaboration could address these challenges.

Recommendation ITU-T F.743.28 specifies a functional framework, requirements and use cases for an intelligent inspection system based on cloud-edge-device collaboration in smart grids. It provides guidance for the utilization and selection of the right inspection system for a specific application. It can also supply a new collaboration paradigm to existing standards in smart grids.

History *

Edition	Recommendation	Approval	Study Group	Unique ID
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Cloud-edge-device collaboration, functional framework, intelligent inspection system, requirement, smart grid.

* 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

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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.

NOTE

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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Recommendation ITU-T F.743.28

Functional framework and requirements for an intelligent inspection system based on cloud-edge-device collaboration in smart grids

1 Scope

This Recommendation specifies the functional framework and requirements for an intelligent inspection system based on cloud-edge-device collaboration in smart grids and provides a use case in smart grids.

The scope of this Recommendation includes:

- Overview
- Functional framework
- Requirements
- Use case

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.747.13](#)] Recommendation ITU-T F.747.13 (2023), *Requirements and reference framework of cloud-edge collaboration in industrial machine vision systems*.
- [[ITU-T X.1815](#)] Recommendation ITU-T X.1815 (2023), *Security guidelines and requirements for IMT-2020 edge computing services*.
- [[ITU-T Y.3510](#)] Recommendation ITU-T Y.3510 (2016), *Cloud computing infrastructure requirements*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 artificial intelligence [b-ISO/IEC 2382]: An interdisciplinary field, usually regarded as a branch of computer science, dealing with models and systems for the performance of functions generally associated with human intelligence, such as reasoning and learning.

3.1.2 cloud computing [b-ITU-T Y.3500]: Paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand.

3.1.3 collaboration [b-ISO 13374-2]: A relation between two objects in a collaboration diagram, indicating that messages can pass back and forth between the objects.

3.1.4 edge computing [b-ITU-T Y.3073]: This refers to a strategy to deploy the processing capability at the network edge where end terminals are connected, and to perform the processing of data which is derived from and fed to the end terminals.

3.1.5 model [b-ITU-T F.748.16]: An output created by an algorithm running on training data that can generate an inference or prediction, based on input data.

3.1.6 smart grid [b-ITU-T Y.4251]: An electricity network that can intelligently integrate the actions of all users connected to it – generators, consumers and those that do both – in order to efficiently deliver sustainable, economic and secure electricity supplies.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AI	Artificial Intelligence
API	Application Programming Interface
CPU	Central Processing Unit
GNSS	Global Navigation Satellite Systems
IP	Internet Protocol
MQTT	Message Queuing Telemetry Transport
NTP	Network Time Protocol
O&M	Operation and Maintenance
QoS	Quality of Service
REST	Representational State Transfer
TCP	Transmission Control Protocol
UAV	Unmanned Aerial Vehicle
UDP	User Datagram Protocol

5 Conventions

- 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 needs not be present to claim conformance.
- The keywords "can optionally" 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 Overview

As power systems continue to advance, there are significant changes to inspection systems in terms of technical characteristics and functional forms. The perception devices, such as cameras, robots and unmanned aerial vehicles (UAVs), used in intelligent inspection systems are typical imaging and video surveillance systems, which are used to remotely capture and present multimedia to maintenance staff, with ensured quality, security and reliability.