SLOVENSKI STANDARD
SIST-TS CLC/TS 50600-4-31:2024

01-december-2024

Informacijska tehnologija - Objekti in infrastrukture podatkovnega centra – 4-31. del: Ključni kazalniki uspešnosti za odpornost

Information technology - Data centre facilities and infrastructures - Part 4-31: Key performance indicators for Resilience

Informationstechnik - Einrichtungen und Infrastrukturen von Rechenzentren - Teil 4-31: Leistungskennzahlen für die Ausfallsicherheit

Technologie de l'information - Installation et infrastructures de centres de traitement de données - Partie 4-31: Indicateurs-clés de performance pour la résilience

Ta slovenski standard je istoveten z: **CLC/TS 50600-4-31:2024**

ICS:

35.020	Informacijska tehnika in tehnologija na splošno	Information technology (IT) in general
35.110	Omreževanje	Networking
35.160	Mikroprocesorski sistemi	Microprocessor systems

SIST-TS CLC/TS 50600-4-31:2024 **en**

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CLC/TS 50600-4-31

October 2024

ICS 35.020; 35.110; 35.160

English Version

Information technology - Data centre facilities and infrastructures - Part 4-31: Key performance indicators for Resilience

Technologie de l'information - Installation et infrastructures de centres de traitement de données - Partie 4-31: Indicateurs-clés de performance pour la résilience

Informationstechnik - Einrichtungen und Infrastrukturen von Rechenzentren - Teil 4-31: Leistungskennzahlen für die Resilienz

This Technical Specification was approved by CENELEC on 2024-09-02.

CENELEC members are required to announce the existence of this TS in the same way as for an EN and to make the TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. CLC/TS 50600-4-31:2024 E

Contents

Page

European foreword

This document (CLC/TS 50600-4-31:2024) has been prepared by CLC/TC 215, “Electrotechnical aspects of telecommunication equipment”.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document is based on, but not identical to, ISO/IEC TS 22237-31:2023.

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

Any feedback and questions on this document should be directed to the users’ national committee. A complete listing of these bodies can be found on the CENELEC website.

Introduction

The unrestricted access to internet-based information demanded by the information society has led to an exponential growth of both internet traffic and the volume of stored/retrieved data. Data centres are housing and supporting the information technology and network telecommunications equipment for data processing, data storage and data transport. They are required both by network operators (delivering those services to customer premises) and by enterprises within those customer premises.

Data centres usually provide modular, scalable and flexible facilities and infrastructures to easily accommodate the rapidly changing requirements of the market. In addition, energy consumption of data centres has become critical both from an environmental point of view (reduction of environmental footprint) and with respect to economical considerations (cost of energy) for the data centre operator.

The implementation of data centres varies in terms of:

a) purpose (enterprise, co-location, co-hosting or network operator facilities);

b) security level;

c) physical size;

d) accommodation (mobile, temporary and permanent constructions).

The needs of data centres also vary in terms of availability of service, the provision of security and the objectives for energy efficiency. These needs and objectives influence the design of data centres in terms of building construction, power distribution, environmental control, telecommunications cabling and physical security as well as the operation of the data centre. Effective management and operational information are important in order to monitor achievement of the defined needs and objectives.

Recognizing the substantial resource consumption, particularly of energy, of larger data centres, it is also important to provide tools for the assessment of that consumption both in terms of overall value and of source mix and to provide Key Performance Indicators (KPIs) to evaluate trends and drive performance improvements.

At the time of publication of this document, the EN 50600 series is designed as a framework of standards, technical specifications and technical reports covering the design, the operation and management, the key performance indicators for energy efficient operation of the data centre as well as a data centre maturity model.

The EN 50600-2 series defines the requirements for the data centre design.

The EN 50600-3 series defines the requirements for the operation and the management of the data centre.

The EN 50600-4 series defines the key performance indicators for the data centre.

The CLC/TS 50600-5 series defines the data centre maturity model requirements and recommendations.

The CLC/TR 50600-99-X Technical Reports cover recommended practices and guidance for specific topics around data centre operation and design.

This series of documents specifies requirements and recommendations to support the various parties involved in the design, planning, procurement, integration, installation, operation and maintenance of facilities and infrastructures within data centres. These parties include:

1) owners, operators, facility managers, ICT managers, project managers, main contractors;

2) consulting engineers, architects, building designers and builders, system and installation designers, auditors, test and commissioning agents;

3) facility and infrastructure integrators, suppliers of equipment;

4) installers, maintainers.

At the time of publication of this document, the EN 50600-4 series comprises the following documents:

— EN 50600-4-1, *Information technology — Data centre facilities and infrastructures — Part 4-1: Overview of and general requirements for key performance indicators*

— EN 50600-4-2, *Information technology — Data centre facilities and infrastructures — Part 4-2: Power Usage Effectiveness*

— EN 50600-4-3, *Information technology — Data centre facilities and infrastructures — Part 4-3: Renewable Energy Factor*;

— EN 50600-4-6, *Information technology — Data centre facilities and infrastructures — Part 4-6: Energy Reuse Factor*;

— EN 50600-4-7, *Information technology — Data centre facilities and infrastructures — Part 4-7: Cooling Efficiency Ratio;*

— EN 50600-4-8, *Information technology — Data centre facilities and infrastructures — Part 4-8: Carbon Usage Effectiveness;*

— EN 50600-4-9, *Information technology — Data centre facilities and infrastructures — Part 4-9: Water Usage Effectiveness.*

The inter-relationship of the documents within the EN 50600 series is shown in Figure 1.

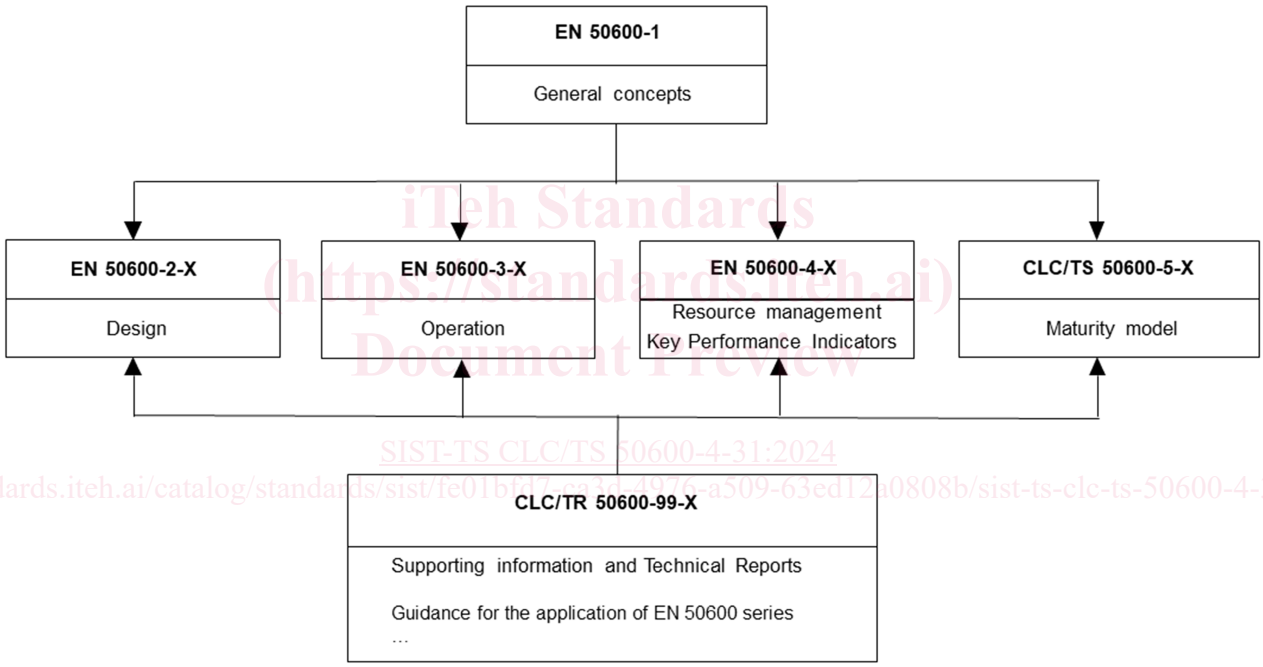

Figure 1 — Schematic relationship between the EN 50600 series documents

EN 50600-2-X documents specify requirements and recommendations for particular facilities and infrastructures to support the relevant classification for “availability”, “physical security” and “energy efficiency enablement” selected from EN 50600-1.

EN 50600-3-X documents specify requirements and recommendations for data centre operations, processes and management.

EN 50600-4-X documents specify requirements and recommendations for key performance indicators (KPIs) used to assess and improve the resource usage efficiency and effectiveness, respectively, of a data centre.

NOTE Within the EN 50600-4-X series, the term “resource usage effectiveness” is more generally used for KPIs in preference to “resource usage efficiency”, which is restricted to situations where the input and output parameters used to define the KPI have the same units.

The various parts of the EN 50600 series reference four qualitative Availability Classes as well as structural definitions to categorize different designs. The documents also refer to resilience criteria in order to improve structural requirements for a qualitative approach.

This document introduces quantitative metrics as key performance indicators (KPIs), in order to meet the requirements necessary for evaluating or comparing different designs or to validate service level agreements (SLAs) for data centres. The proposed KPIs cover resilience attributes, including dependability and fault tolerance metrics. The characteristics of aging of infrastructures are covered by reliability criteria.

Through the use of KPIs, the comparison of designs, functional elements and components of infrastructure designs becomes possible. In addition, it is possible to optimize data centre infrastructures (DCI) with holistic targets. It is recommended to use the KPIs of this document in combination with the efficiency and sustainability KPIs of the EN 50600-4 series.

EN 50600-1:2019, Annex A, demonstrates that a single KPI, such as Availability, is not sufficient to describe the complexity of a DCI. In recognition, this document has been developed in order to compare and value different designs with different Availability Classes of DCIs based on a set of selected KPIs.

Furthermore, the document has been created to establish KPIs for resilience of DCIs with defined resilience levels. The resilience objectives can vary depending on the outcome of the EN 50600-1 risk analysis, the end user information technology equipment (ITE) process criticality, and the data centre type of business.

Using the different stages of a data centre design process, this document describes in which phases the application of KPIs for resilience is appropriate. With its assistance, data centre designers, planners and operators will be supported in defining resilience Levels, performing theoretical assessments and designing and operating DCIs which are able to meet SLAs.

Additional standards in the EN 50600-4-X series will be developed, each describing a specific KPI for resource usage effectiveness or efficiency.

The EN 50600-4-X series does not specify limits or targets for any KPI and does not describe or imply, unless specifically stated, any form of aggregation of individual KPIs into a combined nor an overall KPI for data centre resource usage effectiveness or efficiency.

This document is intended for use by and collaboration between architects, building designers and builders, system and installation designers and main contractors.

This series of documents does not address the selection of information technology and network telecommunications equipment, software and associated configuration issues.

1 Scope

This document

a) defines metrics as key performance indicators (KPIs) for resilience, dependability, fault tolerance and availability tolerance for data centres;

b) covers the data centre infrastructure (DCI) of power distribution and supply, and environmental control;

c) can be referred to for covering further infrastructures, e.g. telecommunications cabling;

d) defines the measurement and calculation of the metrics and resilience levels (RLs);

e) targets maintainability, recoverability and vulnerability;

f) provides examples for calculating these KPIs for the purpose of analytical comparison of different DCIs.

This document does not apply to IT equipment, cloud services, software or business applications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50600-1:2019, *Information technology — Data centre facilities and infrastructures — Part 1: General concepts*

EN 50600-2-2:2019, *Information technology — Data centre facilities and infrastructures — Part 2-2: Power supply and distribution*

EN 50600-2-3, *Information technology — Data centre facilities and infrastructures — Part 2-3: Environmental control*

EN 50600-4-1, *Information technology — Data centre facilities and infrastructures — Part 4-1: Overview of and general requirements for key performance indicators*

3 Terms, definitions, abbreviations and symbols

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 50600-1, EN 50600-2-2, EN 50600-2-3 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
availability
ability to be in a state to perform as required

[SOURCE: IEC 60050-192:2015, 192-01-23 – modified: Notes 1 and 2 have been deleted]

3.1.2
availability tolerance
ability to be in a state to perform as required with certain failures present

3.1.3
dependability
ability to perform as and when required

Note 1 to entry: In this document, the term is used for the determination of data centre reliability, availability and failure rate.

[SOURCE: IEC 60050-192:2015, 192-01-22 – modified: Notes 1 and 2 to entry have been replaced by a new Note 1 to entry]

3.1.4
double point of failure
combination of two functional elements whose simultaneous failures causes overall system fault

[SOURCE: IET, Journal of Engineering, Vol. 2019 Iss. 12, 99. 8419-8427] [13]

3.1.5
double point of reduced availability
combination of two functional elements whose simultaneous failures result in the violation of the service level agreement

[SOURCE: IET, Journal of Engineering, Vol. 2019 Iss. 12, 99. 8419-8427] [13]

3.1.6
down state
state of being unable to perform as required, due to failures or faults

Note 1 to entry: The state can be related to failures of items or faults at a specified operation point (OP)

[SOURCE: IEC 60050-192:2015, 192-02-20, modified – definition has been reworded and Notes 1 and 2 have been replaced by a new Note to entry]

3.1.7
event
something that happens and leads to one or more failures or faults

3.1.8
failure
<of an item> loss of ability to perform as required

Note 1 to entry: In this context it is irrelevant if the cause was planned or unplanned.

[SOURCE: IEC 60050-192:2015, 192-03-01 – modified: Notes 1 to 3 to entry have been replaced by Note 1 to entry]

3.1.9
failure rate
limit of the ratio of the conditional probability that the instant of time, T, of a failure of a product falls within a given time interval (t, $t + \Delta t$) and the duration of this interval, Δt, when Δt tends towards zero, given that the item is in an up state at the start of the time interval

[SOURCE: IEC 60050-821:2017, 821-12-21 – modified: Notes 1 and 2 have been deleted]

3.1.10
fault
inability to perform as required, due to an internal state

Note 1 to entry: Opposite of success. In the context of the expected resilience level (RL), at a specified operation point (OP).

[SOURCE: IEC 60050-192:2015, 192-04-01, modified – Notes 1 to 4 have been replaced by a new Note to entry]

3.1.11
fault tolerance
ability to continue functioning with certain faults present

[SOURCE: IEC 60050-192:2015, 192-10-09]

3.1.12
information technology equipment
equipment providing data storage, processing and transport services together with equipment dedicated to providing direct connection to core and/or access networks

[SOURCE: EN 50600-2-2:2019, 3.1.13]

3.1.13
infrastructure
technical systems providing functional capability of the data centre

Note 1 to entry: Examples are power distribution, environmental control, telecommunications cabling, physical security.

[SOURCE: EN 50600-1:2019, 3.1.22, modified: examples were moved into Note 1 to entry and “telecommunications cabling” has been added to the list

3.1.14
inherent availability
availability provided by the design under ideal conditions of operation and maintenance

Note 1 to entry: Delays associated with maintenance, such as logistic and administrative delays, are excluded.

[SOURCE: IEC 60050-192:2015, 192-08-02]

3.1.15
mean down time
average downtime caused by scheduled and unscheduled maintenance, including any logistics time

Note 1 to enty: For the purposes of this document, this definition deliberately differs from that given in IEC 60050-192:2015, 192-08-10.

[SOURCE: IEEE Std. 493-2007, Annex Q]

3.1.16
mean operating time between failures
average time calculated between failure occurrences

Note 1 to enty: For the purposes of this document, this definition deliberately differs from that given in IEC 60050-192:2015, 192-05-13.

[SOURCE: IEEE Std. 493-2007, Annex Q]

3.1.17
mean operating time to failure
expectation of the operating time to failure

Note 1 to entry: In the case of non-repairable items with an exponential distribution of operating times to failure, i.e. a constant failure rate, the mean operating time to failure is numerically equal to the reciprocal of the failure rate. This is also true for repairable items if after restoration they can be considered to be “as-good-as-new”.

Note 2 to entry: The term “mean time to failure” (MTTF) is used synonymously in this document.

[SOURCE: IEC 60050-192:2015, 192-05-11 – modified: Note 2 to entry was replaced by the one above]

3.1.18
mean time between maintenance
average time between scheduled and unscheduled maintenance, including any logistics time

[SOURCE: IEEE Std. 493-2007, Annex Q]

3.1.19
mean time to restoration
average time to accomplish repairs on an item

Note 1 to entry: For the purposes of this document, this definition deliberately differs from that given in IEC 60050-192:2015, 192-07-23.

[SOURCE: IEEE Std. 493-2007, Annex Q]

3.1.20
normal resilience level
resilience level mandatory during nominal operation

3.1.21
operation point
point of reference for which calculation of resilience level is performed

Note 1 to entry: This can be an individual socket taking into account the entire data centre Infrastructure (DCI) or certain defined parts of the infrastructure. The documentation of the referenced operation point (OP) is required for any key performance indicator (KPI).

3.1.22
operational availability
availability experienced under actual conditions of operation and maintenance

[SOURCE: IEC 60050-192:2015, 192-08-03 – modified: Note 1 to entry has been deleted]

3.1.23
past availability
availability measured during a period of 1 year

Note 1 to entry: For the purposes of this document, 1 year equals 8 760 hours.

3.1.24
reduced resilience level
resilience level mandatory during reduced operation in case of one or more failures

3.1.25
resilience
ability to withstand and reduce the magnitude and/or duration of disruptive events, including the capability to anticipate, absorb, adapt to, and/or rapidly recover from such an event

[SOURCE: IEEE Task Force on Definition and Quantification of Resilience, PES-TR65:2018-04] [14]

3.1.26
resilience level
enumeration of attributes for the determination of resilience aspects of a defined service at a defined operation point (OP)

3.1.27
redundancy
<in a system> provision of more than one means for performing a function

Note 1 to entry: In a data centre, redundancy can be achieved by duplication of devices, functional elements, and/or supply paths.

[SOURCE: IEC 60050-192:2015, 192-10-02, modified – Note 1 to entry has been replaced by a new Note 1 to entry.]

3.1.28
reliability
ability to perform as required, without failure, for a given time interval, under given conditions

[SOURCE: IEC 60050-192:2015, 192-01-24, modified – Notes 1 to 3 to entry have been deleted.]

3.1.29
resilience model
representation x of the data centre infrastructure (DCI) that shows all required subsystems, components and items as well as their systemic interdependencies

3.1.30
service level agreement
agreement defining the content and quality of the service to be delivered and the timescale in which it is to be delivered

[SOURCE: EN 50600-3-1:2016, 3.1.20]

3.1.31
single point of failure
functional element whose failure causes overall system fault

[SOURCE: IET, Journal of Engineering, Vol. 2019 Iss. 12, 99. 8419-8427] [13]

3.1.32
single point of reduced availability
functional element whose failure results in the violation of the service level agreement

[SOURCE: IET, Journal of Engineering, Vol. 2019 Iss. 12, 99. 8419-8427] [13]

3.1.33
socket
connection enabling supply of power to attached equipment

Note 1 to entry: This can be a de-mateable or a hardwired connection.

[SOURCE: EN 50600-2-2:2019, 3.1.29]

3.1.34
system success path
infrastructural path, consisting of a minimum of functional elements, to express the success of the infrastructure system at the operation point (OP) to be in the up state

Note 1 to entry: Each functional element can consist of one or more devices.

3.1.35
time interval
part of the time axis limited by two instants

[SOURCE: IEC 60050-113:2011, 113-01-10, modified – Notes 1 to 3 have been deleted.]

3.1.36
up state
state of being able to perform as required

Note 1 to entry: The state can be related to items or to a specified operation point (OP).

[SOURCE: IEC 60050-192:2015, 192-02-01 modified – Notes 1 to 4 have been deleted and replaced by a new Note to entry.]

3.2 Abbreviations

For the purposes of this document, the abbreviations given in EN 50600-1, EN 50600-4-1 and the following apply.

DCI	data centre infrastructure (infrastructure residing within a data centre)
DPoF	double point of failure
DPoRA	double point of reduced availability
FAT	factory acceptance test
FMECA	Failure Mode Effects and Criticality Analysis
ITE	information technology equipment
KPI	key performance indicator
MDT	mean down time
MTBF	mean operating time between failures
MTBM	mean time between maintenance
MTTF	mean time to failure
MTTR	mean time to restoration
NRL	normal resilience level
OP	operation point
PDF	probability density function
PREP	power reliability enhancement program
RBD	reliability block diagram
RL	resilience level
RRL	reduced resilience level
SLA	service level agreement
SPoF	single point of failure
SPoRA	single point of reduced availability
SSP	system success path
UPS	Uninterruptible Power System

3.3 Symbols

For the purposes of this document, the symbols given in EN 50600-1, EN 50600-4-1 and the following apply.

α	confidence rate
A_i	inherent availability
A_o	operational availability