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Bilgi teknolojisi - Veri merkezi tesisleri ve altyapıları - Bölüm 4-1: Temel performans göstergelerine genel bakış ve genel gereklilikler
EN 50600-4-1:2016

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

Technologie de l'information - Installation et infrastructures de centres de traitement de données - Partie 4-1 : Vue d'ensemble et exigences générales relatives aux indicateurs-clés de performance

Informationstechnik - Einrichtungen und Infrastrukturen von Rechenzentren - Teil 4-1:¨¨berblick über und allgemeine Anforderungen an Leistungskennzahlen

TÜRK STANDARDI

Milli Önsöz

Bu standard, CLC/TC 215 "Electrotechnical aspects of telecommunication equipment - Telekomünikasyon ekipmanlarının elektroteknik yönleri" Teknik Komitesi tarafından hazırlanmış, CENELEC tarafından 10.10.2016 tarihinde onaylanmış ve Türk Standardları Enstitüsü Teknik Kurulu'nun 20.03.2017 tarihli toplantısında Türk Standardı olarak kabul edilerek yayımına karar verilmiştir.

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EUROPEAN STANDARD

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
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European foreword

This document (EN 50600-4-1:2016) has been prepared by CLC/TC 215 "Electrotechnical aspects of telecommunication equipment".

The following dates are fixed:

· Latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	[2017-07-10]
· Latest date by which the national standards conflicting with this document have to be withdrawn	(dow)	[2019-10-10]

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Regarding the various parts in the EN 50600 series, see the Introduction.

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 need to 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 carbon footprint) and with respect to economic 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 and physical security. Effective management and operational information is required to monitor achievement of the defined needs and objectives.

This series of European Standards 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, facility managers, ICT managers, project managers, main contractors;

2)   architects, consultants, building designers and builders, system and installation designers;

3)   facility and infrastructure integrators, suppliers of equipment;

4)   installers, maintainers.

At the time of publication of this European Standard, the EN 50600 series will comprise the following standards and documents:

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

— EN 50600-2-1, *Information technology — Data centre facilities and infrastructures — Part 2-1: Building construction*;

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

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

— EN 50600-2-4, *Information technology — Data centre facilities and infrastructures — Part 2-4: Telecommunications cabling infrastructure*;

— EN 50600-2-5, *Information technology — Data centre facilities and infrastructures — Part 2-5: Security systems*;

— EN 50600-3-1, *Information technology — Data centre facilities and infrastructures — Part 3-1: Management and operational information*;

— 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*;

— CLC/TR 50600-99-1, *Information technology — Data centre facilities and infrastructures — Part 99-1: Recommended practices for energy management*.

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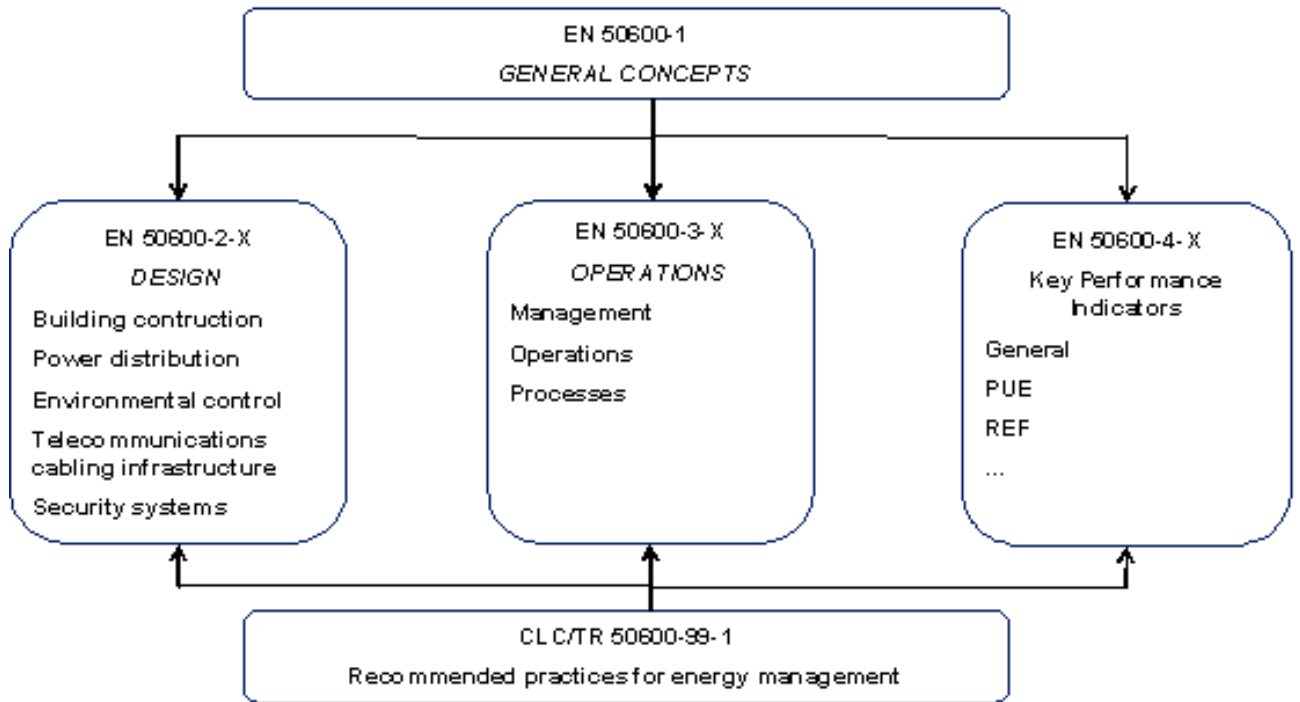
Figure 1 — Schematic relationship between the EN 50600 series of documents

EN 50600-2-X standards 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.

In today's digital society data centre growth, and power consumption in particular, is an inevitable consequence and that growth will demand increasing power consumption despite the most stringent energy efficiency strategies. This makes the need for key performance indicators that cover the effective use of resources (including but not limited to energy) and the reduction of CO_2 emissions essential.

NOTE   Within the EN 50600–4 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.

In order to enable the optimum resource effectiveness of data centres a suite of effective KPIs is needed to measure and report on resources consumed in order to develop an improvement roadmap.

These standards are intended to accelerate the provision of operational infrastructures with improved resource usage effectiveness.

This European Standard provides an overview of and defines general requirements for key performance indicators specified in the EN 50600-4 series. The common objective of the KPIs is the effective or efficient use of resources, for example:

• the minimization of energy and other resource (e.g. water) consumption;

• task effectiveness of the IT load (data processing, storage and transport) within the data centre, maximizing the IT output with the minimum energy consumption;

• energy reuse in the form of waste heat, if possible;

• the use of renewable energy, both generated on site and off site.

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

The EN 50600-4 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 European Standard is intended for use by and collaboration between data centre managers, facility managers, ICT managers and main contractors.

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

1   Scope

This European Standard specifies the following for the other standards in the EN 50600-4-X series:

a)   a common structure,

b)   definitions, terminology and boundary conditions for KPIs of data centre resource usage effectiveness and efficiency,

c)   common requirements for KPIs of data centre resource usage effectiveness and efficiency,

d)   common objectives for KPIs of the data centre resource effectiveness and efficiency,

e)   general information regarding the use of KPIs of data centre resource usage effectiveness and efficiency.

2   Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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, *Information technology — Data centre facilities and infrastructures — Part 1: General concepts*

3   Terms, definitions and abbreviations

3.1   Terms and definitions

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

3.1.1
information technology equipment
equipment providing data storage, processing and transport services including telecommunications network equipment dedicated to providing direct connection to core and/or access networks

3.1.2
key performance indicator
number representing the resource usage effectiveness or efficiency of a given system

3.1.3
resource usage effectiveness
ratio of resulting output to a resource consumed to produce that output when the input and output units are not the same

Note 1 to entry: The term is used generically to describe the conversion of a resource to an output or outcome, such as litres of water per kWh.

3.1.4
resource usage efficiency
ratio of output to the resource used by the device or system when the input and output units are the same

3.2   Abbreviations

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

AC   Alternating Current

DC   Direct Current

IT   Information Technology

KPI   Key Performance Indicator

SLA   Service Level Agreement

UPS   Uninterruptible Power Supply

4   Conformance

In order for a KPI of data centre resource usage effectiveness or efficiency to be included in the EN 50600-4 series it shall:

a)   meet the common objectives outlined in 5.2;

b)   meet the requirements of 5.3;

c)   meet the structure requirements of 5.4;

d)   meet the use requirements of 5.5.

5   Key Performance Indicators (KPIs)

5.1   General

The EN 50600-4 series defines requirements for the KPIs that are used to address aspects of data centre resource usage effectiveness or efficiency.

Due to the variable nature of type, size, purpose and geographical location of data centres and in order to meet the common objectives defined in 5.2, it is not possible to define a single, universally relevant KPI for resource usage effectiveness or efficiency. As a result, the EN 50600-4 series specifies a suite of KPIs, each of which may be used to measure and report different, and relevant, aspects of resource usage effectiveness or efficiency.

This clause defines:

a)   common objectives for KPIs (see 5.2);

b)   the general requirements for a KPI to be included within the EN 50600-4 series (see 5.3);

c)   a common structure within the EN 50600-4 series (see 5.4);

d)   rules for the use of KPIs (see 5.5).

5.2 Common Objectives for KPIs

The common objective of the KPIs of EN 50600-4 series is the efficient or effective use or utilization of resources, for example:

a)   minimization of energy and other resource consumption;

b)   effectiveness of the IT load (processing, storage and transport) within the data centre, maximizing the IT output with the minimum energy consumption;

c)   reuse of unconsumed resources (e.g. energy reuse in the form of waste heat);

d)   utilization of renewable energy, both generated on site and off site.

The KPIs of the EN 50600-4 series are designed and intended to allow an individual facility to measure and monitor progress in each individual area so as to justify investment in resource usage effectiveness or efficiency measures and plan further improvements.

In order for a KPI to become a candidate for inclusion into the EN 50600-4 series, it shall be:

1)   applicable to all types of data centres;

2)   technology neutral;

3)   geographically neutral.

5.3 Requirements for KPIs

5.3.1 General

In order for a KPI to be included in the EN 50600-4 series the KPI shall meet the requirements of 5.3.2 to 5.3.10.

5.3.2 Scale

Data centres vary widely in terms of scale (i.e. the maximum design service implementations). KPIs shall be valid for all scales of data centres.

5.3.3 Evolution

Data centres

a)   generally do not go from 'zero' to full utilization on day one;

b)   tend to feature power demands that grow from day one moving towards the maximum design load and at any point strategic changes may take place (such as the procurement of more efficient IT equipment) which can reduce the load before once again beginning to grow towards the maximum design load.

KPIs shall be valid for all 'states of evolution' of an operational infrastructure.

5.3.4 Formulae

Each KPI shall be defined in clear and unambiguous mathematical terms.

5.3.5 Definition of boundaries

Each KPI shall define the elements of the data centre infrastructure to be included in any measurements or calculations (see Clause 6).

Each KPI shall define the treatment of resources at the interfaces to the system to which the KPI applies.

5.3.6 Reporting

Each KPI shall define the reporting requirements for resources relevant to the determination of the KPI.

5.3.7 Definition of terms

Each KPI shall clearly define all terms relevant to its application.

5.3.8 Measurement points and procedures

Each KPI shall be based upon parameters that are measureable in an unambiguous manner. The measurement points shall be included for each KPI.

The following procedures shall be followed:

a)   each KPI shall be assessed over a defined period of time;

b)   all parameters relevant to the assessment of the KPI shall be measured over a period not exceeding a specified time;

c)   the maximum time between measurements defines the time interval between which KPIs shall be re-assessed.

Continuous measurements of KPIs are recommended, where applicable.

5.3.9 Requirements

Each KPI shall clearly define strict requirements for inclusions/exemptions/exclusions within the formulae.

5.3.10 Classifications

Each KPI shall clearly define any classification systems that apply to its application.

5.4   Elements addressed in the standards within the EN 50600-4 series

Standards within the EN 50600-4 series shall address the following aspects:

a)   identification and definition of the consumption of the resource(s);

b)   justification and description of its importance to the data centre operator;

c)   definition of the indicator;

d)   description of the formulae and calculation method;

e)   description of the measurement points and procedures.

The standards within the EN 50600-4 series shall also include the following components:

1)   interpretation and actions;

2)   scale – how the KPI meets the requirement of applicability to all scales of facilities;

3)   reporting requirements - including classifications or context indicators;

4)   exemptions and/or exceptions for each KPI

5)   a clear definition of all terms relevant to the application of the KPI;

5)   reference of use/application in a stand-alone data centre or mixed-use building;

6)   each KPI shall include an Annex where application examples and case studies shall be found.

5.5   Use of KPIs

KPIs shall be presented as numeric values, and units where applicable, and can be trended against time in graphical form if required. Due to the diverse nature of the numerical value of individual KPIs comparison with other data centres, and combinations of KPIs should be approached with caution.

Visualization of a combination of KPIs shall only be undertaken if the combination is both informative and actionable.

KPIs in the EN 50600-4 series are not intended to be:

a)   used in sub-combination unless specifically stated;

b)   aggregated into a single overall KPI, nor is it advised to do so;

c)   used to compare the resource usage effectiveness or efficiency of one data centre with another.

It is recognized that data centres which feature high levels of infrastructural resilience (e.g. power distribution and environmental control) can have a negative impact on any KPIs measured and reported. The KPIs specified in the EN 50600-4 series do not take into account, or make judgement upon, the needs for such resilience. As a result, the impact of targets for data centre reliability and availability should be taken into consideration when reviewing KPI results (for further information see Annex A).

6   Data Centre Boundaries

6.1   General

Data centre boundaries define the contents and scope of the structure being considered by the KPI. Boundaries are described by the perimeter, spaces, and equipment contained therein.

Boundaries may be based on spatial and logical considerations (see 6.2) or include other parameters.

6.2   Spatial and logical boundaries

The boundary descriptions may be in terms of aggregate space and electrical load, but shall include key elements of space and equipment considered as the 'data centre' under evaluation. Changes to the boundaries require updates to the KPI in order to evaluate the efficiency and/or effectiveness changes in the 'data centre' under consideration. These boundaries shall be described and accompany the disclosure or report of the KPI.

Typical boundaries shall include the perimeter of the data centre property, for example for power or water. Other sub-section boundaries may be established for a KPI, such as that for the cooling system where the boundary is the energy interface enclosing the cooling system itself.

7   Data Centre spaces and equipment

7.1   Data Centre spaces

EN 50600-1 defines those areas within a premises that are designated the data centre spaces.

7.2   Data centre equipment (logical boundaries)

7.2.1   IT and network telecommunications/infrastructure

The infrastructure used to process, store and transport data includes, but is not limited to:

a)   servers and computing systems: e.g. servers, hardware accelerators, digital and physical security devices, workload schedulers, workstations;

b)   networking and communication equipment: e.g. switches, routers, firewall, network analyzers, networking appliances;

c)   data storage equipment: e.g. storage arrays, data archive appliances;

d)   supporting electronic equipment: IT/data services control equipment and displays, control terminals, printers.

7.2.2   Power distribution infrastructure

EN 50600-2-2 specifies the power distribution infrastructure within a data centre.

7.2.3   Environmental control/infrastructure

EN 50600-2-3 specifies the environmental control infrastructure within a data centre.

7.2.4   Security and safety infrastructure

EN 50600-2-5 specifies the requirements for security systems within a data centre.

Annex A
(informative)

KPI constraints and data centre criticality

A.1 General

The KPIs of the EN 50600-4 series are intended to promote the reduction of the environmental impacts of a data centre. However, availability objectives and location can constrain the achievable improvements.

There should be no 'judgement' of an actual KPI without attaching to the data point a description of availability objectives and the location/climate of the data centre under consideration. KPIs should be used to help data centre managers to improve the data centre's resource usage effectiveness or efficiency by comparing and assessing improvement options.

A.2 Data centre availability objectives

The availability objectives of a data centre can restrict such improvements due to the use of redundant infrastructure components and infrastructures necessary to respond the following circumstances

a) the user of the data centre will either set or demand a series of Service Level Agreements (SLAs) based upon the criticality of their business case covering continuity and quality of power and environmental control provision, connectivity and security;

b) the SLAs will reflect directly the appetite for risk that the user has and their ability or willingness to accept shutdowns for maintenance and repairs in the critical systems;

c) data centres whose users can accept high levels of risk, scheduled shutdowns for maintenance and shutdowns for fault repair might use less resources;

d) data centres whose users cannot accept risk of failure and demand concurrent maintenance and inherent fault tolerance are limited by those SLAs and might use more resources.

Infrastructure design solutions to provide increasing availability are described in the EN 50600-2 series. These solutions range from "single-path (no redundancy of components)" to "multi-path (fault tolerant even during maintenance)."

The power supply and distribution system provides an example of the relationship between absolute energy consumption (contribution to KPIs) and availability of service (level of SLA). Typically, IT equipment will be impacted by disruption of supply lasting longer than 10 ms and as a result uninterruptible power supply (UPS) systems are generally used to support utility power grid systems unable to meet IT equipment needs. EN 62040-3 describes the topologies of UPS systems and in general the maximum efficiency for each technology reduces as the degree of protection increases. As a result the availability architecture and the level of protection will dictate the contribution to KPIs which address energy consumption of the power supply and distribution system.

Tolerance to faults and ensuring availability to meet SLAs are important factors in the energy consumption of data centre equipment and infrastructures including environmental control. The criticality level and redundancy employed to the power delivery, cooling, IT, and IT support systems are key factors in the resource consumption, effectiveness or efficiency levels of the data centre.

A.3 Data centre location

Resource availability and consumption can be impacted by physical location. For example, free-cooling (compressor-less mechanical thermal management) is less effective for higher external temperatures.

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EN 62040-3, *Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements (IEC 62040-3)*