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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Environmental Engineering (EE).

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Modal verbs terminology

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Introduction

The present document specifies a metric for the assessment of energy efficiency of computer servers using reliable, accurate and reproducible measurement methods, which take into account the recognized state of the art.

The present document formalizes the tools, conditions and calculations used to generate a single figure of merit of a single computer server representing its relative efficiency and power impact. The metric is targeted for use as a tool in the selection process of servers to be provisioned.

For comparisons, evaluations should be conducted across similar server types or categories. The efficiency metric is targeted for use in a pass/fail selection process by differentiating the ability of servers to be provisioned for general purpose operations. The present document does not prescribe the levels or values for acceptance but prescribes a standard method of evaluation that energy efficiency programs would use to establish such criteria.

As there are many operational deployments of servers resulting in a range of specialized equipment and configurations for a single server product, a metric that evaluates provisioning impacts to general purpose operations may not be applicable. ICT equipment and servers in particular, are generally customized and commissioned on site for deployment. As with most IT equipment, new technologies are regularly introduced, which may require product level customization or an industry wide tool upgrade to more appropriately represent the efficiency of the servers. The present document categorizes servers to address applicability, configuration groupings to represent a family of servers to address the broad range of custom configurations possible within each server product family, and tool revision control to ensure comparability and consistency of the resulting metric value.

The present document is based upon the Server Efficiency Rating Tool™ (SERT™) of the Standard Performance Evaluation Corporation (SPEC) and takes into account:

- the Eco-design Technical Assistance Study on Standards for ErP Lot 9 Enterprise Servers and Enterprise Data Storage;
- activity related to the analysis of output of Server Efficiency Rating Tool (SERT™) measurements and deployed power by The Green Grid;
- ENERGY STAR® for Computer Servers [i.2].

The present document defines energy efficiency metrics and measurement methodology for server equipment under standardization mandate M/462 of the European Commission [i.3].

1 Scope

The present document specifies a metric using the Server Efficiency Rating Tool (SERT™), test conditions and product family configuration for the assessment of energy efficiency of computer servers using reliable, accurate and reproducible measurement methods. The metric applies to general purpose computer servers with up to four processor sockets and with their own dedicated power supply.

NOTE 1: The term "socket" also applies to design in which processors are installed without sockets (e.g. soldered products).

The metric applies to a computer server model and to a computer server product family, including type and count of CPU, memory, storage, power supplies, cooling (e.g. fans) and any other add-on hardware expected to be present when deployed.

The present document defines:

- an energy efficiency metric to support procurement or market entry requirements;
- requirements for equipment to perform the measurements and analysis;
- requirements for the measurement process;
- requirements for the management of the metric calculation;
- operation or run rules to configure, execute, and monitor the testing;
- documentation and reporting requirements;
- a validation process for the metric using the Deployed Power Assessment.

The present document is not applicable to:

- fully fault tolerant servers;
- High Performance Computing (HPC) systems;
- hyper-converged servers;
- large scale servers;
- servers with integrated APA(s);
- networking equipment including network servers;
- server appliances;
- storage device including blade storage and storage servers.

NOTE 2: Products whose feature set and intended operation are not addressed by active mode testing parameters are excluded from this evaluation method. The above list shows products for which SERT™ efficiency evaluations are not appropriate.

The present document does not address home servers and small servers that fall under the scope of mandate M/545 [i.8].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference/.

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The following referenced documents are necessary for the application of the present document.

[1] CENELEC EN 62623:2013: "Desktop and notebook computers. Measurement of energy consumption".

[2] Standard Performance Evaluation Corporation (SPEC): "Server Efficiency Rating Tool (SERT) version 2 Run and Reporting Rules".

NOTE: Available at https://www.spec.org/sert2/SERT-runrules.pdf.

[3] Standard Performance Evaluation Corporation (SPEC): "Server Efficiency Rating Tool (SERT) version 2 User Guide".

NOTE: Available at https://www.spec.org/sert2/SERT-userguide.pdf.

[4] IEEE 802.3™: "IEEE Standard for Ethernet".

NOTE: Available at https://standards.ieee.org/findstds/standard/802.3-2015.html.

[5] IEEE 802.3az™: "Energy Efficient Ethernet".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] CENELEC EN 60297 series: "Mechanical structures for electrical and electronic equipment. Dimensions of mechanical structures of the 482,6 mm (19 in) series".

[i.2] ENERGY STAR®: "Product Specification for Computer Servers".

[i.3] Standardization mandate M/462: "M/462 Standardisation mandate addressed to CEN, CENELEC and ETSI in the field of ICT to enable efficient energy use in fixed and mobile information and communication networks".

[i.4] ETSI EN 300 119 series: "Equipment Engineering (EE); European telecommunication standard for equipment practice".

[i.5] Standard Performance Evaluation Corporation (SPEC): "Server Efficiency Rating Tool (SERT) version 2 Design Document".

NOTE: Available at https://www.spec.org/sert2/SERT-designdocument.pdf.

[i.6] SERT Client Configurations (JVM Options).

NOTE: Available at https://www.spec.org/sert2/SERT-JVM_Options-2.0.html.

[i.7] SERT Result File Fields.

NOTE: Available at https://www.spec.org/sert2/SERT-resultfilefields.html.

[i.8] Mandate M/545: "Commission Implementing Decision of 6.1.2016 on a standardisation request to the European standardisation organisations as regards computers and computer servers, in support of the implementation of Commission Regulation (EU) No 617/2013 of 26 June 2013, implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for computers and computer servers".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

a.c.-d.c. power supply unit: power supply unit that converts line-voltage alternating current (a.c.) input power into one or more direct current (d.c.) power outputs for powering a computer server

active state: operational state of a computer server (as opposed to the idle state) in which the computer server is carrying out work in response to prior or concurrent external requests (e.g. instruction over the network)

NOTE: The work includes, but is not restricted to, active processing and data seeking/retrieval from memory, cache, or internal/external storage while awaiting further input over the network.

Auxiliary Processing Accelerator (APA): additional compute device installed in the computer server that handles parallelized workloads

NOTE 1: This includes, but is not limited to, Graphical Processing Units (GPUs) or Field Programmable Gate Array chips which can be installed in a server either on Graphics or Extension add-in cards installed in general-purpose add-in expansion slots (e.g. GPGPUs, CPU accelerators, etc. installed in a PCI slot) or directly attached to a server component such as the motherboard.

NOTE 2: There are two specific types of APAs used in servers:

a) Expansion APA: An APA that is on an add-in card installed in an add-in expansion slot (e.g. GPGPUs, CPU accelerators, etc. installed in a PCI slot). An expansion APA add-in card may include one or more APAs.

b) Integrated APA: An APA that is integrated into the motherboard or CPU package or an expansion APA that has part of its subsystem, such as switches, included in the non-APA server configuration that would be used to run the energy efficiency test (SERT™ suite).

blade chassis: enclosure that contains shared resources for the operation of blade servers, blade storage, and other blade form-factor devices

NOTE: Shared resources provided by a chassis include, but are not restricted to, power supplies, data storage, and hardware for d.c. power distribution, thermal management, system management, and network services.

blade server: computer server, designed for use in a blade chassis, that is a high-density device and functions as an independent computer server and includes at least one processor and system memory, which is dependent upon shared blade chassis resources (e.g. power supplies, cooling) for operation

NOTE: A processor or memory module that is intended to scale up a standalone server is not considered a blade server.

blade storage: storage device that is designed for use in a blade chassis and that is dependent upon shared blade chassis resources (e.g. power supplies, cooling) for operation

blade system: blade chassis and one or more removable blade servers and/or other units (e.g. blade storage, blade networking equipment) which provide a scalable means for combining multiple blade server or storage units in a single enclosure

NOTE: A blade system is designed to allow service technicians to easily add or replace (hot-swap) blades in the field.

buffered Double Data Rate (DDR) channel: channel or memory port connecting a memory controller to a defined number of memory devices (e.g. dual in-line memory modules (DIMMs)) in a computer server

NOTE 1: A typical computer server may contain multiple memory controllers, which may in turn support one or more buffered DDR channels.

NOTE 2: Each buffered DDR channel serves only a fraction of the total addressable memory space in a computer server.

computer server: computer, sold through enterprise channels, that provides services and manages networked resources for client devices

NOTE 1: Client devices include, but are not restricted to desktop computers, notebook computers, thin clients, wireless devices, Personal Digital Assistants, IP telephones, other computer servers, or other network devices.

NOTE 2: A computer server is primarily accessed via network connections, versus directly-connected user input devices such as a keyboard or mouse.

controller system: computer or computer server that manages a benchmark evaluation process

data averaging interval: time period over which all samples captured by the high-speed sampling electronics of the power analyser are averaged to provide the measurement set

d.c.-d.c. power supply unit: power supply unit that converts line-voltage direct current (d.c.) input power to one or more d.c. outputs for powering a computer server

NOTE: For purposes of the present document, a d.c-d.c. converter that is internal to a computer server and is used to convert a low voltage d.c. (e.g. 12 VDC) into other d.c. power outputs for use by computer server components is not considered a d.c-d.c. power supply unit.

deployed power: average power level of the utilization applicable to the total number of servers provisioned to meet an aggregate peak load

direct current server: computer server that is designed solely to operate on a direct current (d.c.) power source

double-wide blade server: blade server requiring twice the width of a standard blade server bay

efficiency: defined workload output divided by the resource input to the system

fully fault tolerant server: computer server that is designed with complete hardware redundancy, in which every computing component is replicated between two nodes running identical and concurrent workloads (i.e. if one node fails or needs repair, the second node can run the workload alone to avoid downtime) and that uses two systems to simultaneously and repetitively run a single workload for continuous availability in a mission critical application

half-height blade server: blade server requiring one half the height of a standard blade server bay

hard disk drive: primary computer storage device which reads and writes to one or more rotating magnetic disk platters

High Performance Computing (HPC) system: computing system which is designed (or assembled), optimized, marketed and sold to execute highly parallel applications for higher performance computing applications

NOTE 1: HPC systems support applications including, but not restricted to, deep learning or artificial intelligence.

NOTE 2: HPC systems feature multiple clustered nodes to increase computational capability and often featuring high speed inter-processing interconnects as well as large memory capability and bandwidth.