



Operational energy Efficiency for Users (OEU); Energy Consumption Measurement of Operational Information Technology Servers

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Operational energy Efficiency for Users (OEU).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction

Information and communication technology (ICT) sites constitute one of the most important areas of the worldwide growing energy consumption. They are responsible for at least 2 % of the worldwide greenhouse gas emissions, still growing.

Energy management performance of ICT sites is an important matter. It is now essential if not vital to implement commitments in order to reduce the energy consumption by ICT sites.

Further to the 1997 Kyoto protocol [i.1], the European Commission has issued, and will issue, Directives in order to improve energy management of networks, sites included, of whole industry sectors.

Therefore suppliers and users of ICT equipment are obliged to implement "Green" tools (indicators, recognized Green levels) to monitor the efficiency of their greener networks.

Consequently, ISG OEU has developed the present document in order to define this operational measurement method.

The present document defines requirements for operational measurement of energy consumption by ICT equipment as well as requirements for technical KPIs allowing selection of energy efficient equipment for specific uses.

1 Scope

The present document defines the current standpoint of ISG OEU members in relation to the operational measurement of energy performance and selection of ICT physical servers.

It defines an energy performance operational KPI and its related measurement points, measurement protocols and transmission. The measured KPI is simply and unequivocally linked to the measured ICT physical server.

It defines technical KPIs allowing to predict energy consumption and task efficiency for specific uses. The technical KPIs is simply and unequivocally linked to the measured ICT physical server. These KPIs allow differentiating energy consumption by noble parts (e.g. CPU, memory, disk, I/O) of ICT physical server of the overall consumption including cooling and power supplies.

An ICT physical server is a general-purpose ICT equipment with its own dedicated power supplies. The aforementioned KPIs applies to specified configurations, including type and count of CPU, memory, storage, power supplies, cooling (e.g. fans) and any other add-on hardware expected to be present in production. In particular, for a blade chassis, it includes the blade enclosure, the blades and all the required I/O interfaces (e.g. switches) included in the blade enclosure.

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>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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

- [1] ETSI EN 300 019-1-3: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weather protected locations".

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.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

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] Kyoto Protocol to the United Nations Framework Convention on Climate Change.

3 Definitions and abbreviations

3.1 Definitions

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

physical ICT server: any general-purpose ICT equipment powered by one or more dedicated power supply

3.2 Abbreviations

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

AS	Application Server
CPU	Central Processor Unit
EE	Environmental Engineering
EN	European Norm
HPC	High Performance Computing
I/O	Input/Output
ICT	Information and Communications Technology
IPMI	Intelligent Platform Management Interface
KPI	Key Performance Indicator
OS	Operating System
SAP	Systems, Applications, and Products for data processing
SFS	Solution File Server
SL	Scalable Line
SNMP	Simple Network Management Protocol
SPEC	Standard Performance Evaluation Corporation®

4 Classification of servers

4.1 General

In order to define the most efficient measurement of server consumption, ICT users propose to divide the world of servers in several functional families.

Performance effectiveness of a server depends on the kind of task it is supposed to fulfil. Performance of each functional family shall be measured with an appropriate KPI that depends on the said family. This KPI shall be then compared to the required power to produce the performance.

4.2 Functional use examples and associated performance KPIs

Table 1 contains example KPI related to example functional uses of servers. Table 1 is not expected to be exhaustive nor exact after the publication.

Table 1

Type	Description	Example KPI
CPU bound	Server the main use of which is CPU	Specint_Rate
I/O bound	Server the main use of which is I/O	Diskspd
Memory bound	Server the main usage of which is memory	PassMark
CPU graphic	Server the main usage of which is graphics processing	SPECviewperf
Mail	Server implementing a mailing system	SPECmail
SAP	Sap systems	Saps
Web Java AS	Application server using java	SPECjbb
Virtualisation	Server used as a support for virtual servers	SPECvirt
Storage	Server used as a storage server	SPEC SFS
Transactional	System for transactional database processing	TpmC
HPC	System characterized by a large number of interconnected CPU bound server	SPECchpc
Web Access	Server used for web access	SpecWeb

4.3 Server gauges

Proposal to classify server against gauges.

Table 2

Category	Size	Example: Hewlett-Packard Enterprise®	Example: Dell®
Stand-Alone	1 socket	MicroServer & Proliant™ ML	PowerEdge™ R2xx
	2 sockets	Proliant™ DL1/3xx	PowerEdge™ R4/6/7xx
	≥ 4 sockets	Proliant™ DL5/9xx	PowerEdge™ R9xx
Blade	≤ 4 slots	Proliant™ SL	PowerEdge™ FX & C
	4 < slots ≤ 16	BladeSystem™	PowerEdge™ M
	> 16 slots	MoonShot™	
NOTE: Proliant™ BladeSystem™ Moonshot™ and PowerEdge™ are examples of a suitable products available commercially. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of these products.			

5 KPIs

5.1 Operational KPIs

5.1.1 General

Operational KPIs refer to measurement of actual server consumptions while in normal operations.

The operational energy consumption by an ICT physical server shall be measured. The measurement shall be unequivocally linked to the physical server being measured. In addition to that, energy consumption by noble parts of the ICT server should be differentiated of the overall consumption.

5.1.2 Measurement points

The energy shall be measured at the hardware level inside the server. The energy consumption data shall be available at the server level by a server interface such as IPMI.

In addition, data should be made available at the OS level and further presented by a remote monitoring protocol such as SNMP. In case a physical ICT server hosts several OS instances, every instance shall be able to provide the same data related to the physical ICT server.

All reportings should include an unique physical server identification such as its serial number to ease reconciliation of different measurements and various data collections.

5.2 Technical KPIs

5.2.1 General

Technical KPIs shall be measured under specified operational conditions such as temperature and relative hygrometry as well as specified benchmark programs. Their aim is to provide energy performance information under these operational conditions running the specified benchmark and are not a guarantee that the same performance will be achieved under different operational conditions.

5.2.2 Power KPIs

Technical KPIs shall be provided for general use of the server. These KPI shall differentiate energy consumption by noble parts of the server (e.g. CPU, Disk, Memory, I/O, etc.) of the overall consumption depending on load and climatic conditions.

The load conditions shall include all the following cases:

- Idle: server powered on, no operating system booted.
- Full load: all components in the ICT physical server are used to their maximum consumption.

In addition, consumption at mid-load should be provided. In such case mid-load definition shall be provided by vendor

The temperature conditions shall include all the following cases:

- Consumption at 23 °C.
- Consumption at maximum temperature supported by the ICT physical server during normal operations.
- Consumption at maximum temperature by ETSI EN 300 019-1-3 [1] (Class 3.1/40 °C) if applicable.

Vendor may add specific temperature conditions to the required above.

Table 3

	Idle	Medium (specify)	Full
23 °C	Total/noble	Total/noble	Total/noble
40 °C	Total/noble	Total/noble	Total/noble
MAX (specify)	Total/noble	Total/noble	Total/noble

5.2.3 Technical task efficiency KPIs

Technical KPIs shall determine the task efficiency of ICT physical servers depending on the available benchmarks currently available (e.g. Tpm-C for transactional processing, SPECweb for web servers) together with their overall power needs at the measured performance at 23 °C.

Table 4

Benchmark	Benchmark value	Overall power needs at 23 °C
Tpm-C	100 000	280 W
SPECweb	50 000	137 W

Clause 4.2 lists a few KPIs from known benchmarks at the time of writing.

6 Communication protocols

6.1 General

This clause only applies to Operational KPIs.

6.2 Protocol description

Industry existing standards such as IPMI or SNMP shall be used. These protocols shall allow to identify unambiguously the physical server they refer to.

6.3 Requirements for expected data

Communication protocol shall include following data:

- Unique identification of originating server.
- Current overall power use from the outlet(s).

6.4 Recommendations for expected data

Communication protocol should include following data:

- Current server energy use from last power-on.
- Duration since last power-on.
- Power use by "noble" parts as defined in clause 5.2.2.
- Energy use since last power-on by "noble" parts as defined in clause 5.2.2.

7 Precision of measure

7.1 General

This clause only applies to Operational KPIs.

7.2 Recommendations

Precision of measurement should be better than 10 %.

8 Conclusion

According to ISG members, these elements appear necessary to ensure a proper selection and field operational follow-up:

- to take into account the present document;
- to issue a specification describing the implementation of an operational process related to the present document.

History

Document history		
V1.1.1	September 2016	Publication