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Information Technology — Data centres — Application Platform Energy Effectiveness (APEE)

Technologies de l'information — Centres de traitement de données — Efficacité énergétique des plateformes d'applications (APEE)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 39, *Sustainability, IT & Data Centres*.

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Introduction

The growth of the Internet of Things (IoT) has resulted in the storage of increasingly large amounts of data in data centres and the increased utilization of this data by technologies such as artificial intelligence (AI). As a result, energy consumption of data centres is also increasing. In this recent utilization of large amounts of data by technologies such as AI, various kinds of data are combined and analysed, and processing requests for such combinations and analysis are also increasing. Middleware, such as a database management system (DBMS), is also becoming more important for this data utilization. The energy effectiveness of application platforms can be greatly improved through the selection of middleware.

In addition to improving the energy effectiveness of target IT equipment itself, it is necessary to improve application platform energy effectiveness by choosing an optimally energy-effective combination of target IT equipment, operating systems and middleware.

Although there are several KPIs for the energy effectiveness of target IT equipment itself (for example, ISO/IEC 30134-4, ISO/IEC 21836), there have previously been no KPIs for energy effectiveness to calculate the energy effectiveness of a combination of target IT equipment, operating systems and middleware. This document, therefore, introduces a KPI for the energy effectiveness of an entire application platform. A typical use case of application platform energy effectiveness (APEE) is a criterion for procuring an energy efficient application platform for an IT service.

This KPI provides assistance in selecting an optimal application platform for energy effectiveness. This KPI does not apply to the energy effectiveness of an entire data centre. The colloquial term of "efficiency" is commonly used in regional programmes and "effectiveness" can be referenced as "efficiency" in those programmes.

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Information Technology — Data centres — Application Platform Energy Effectiveness (APEE)

1 Scope

This document specifies application platform energy effectiveness (APEE) as a Key Performance Indicator (KPI) which quantifies the energy effectiveness of an application platform for an IT service in data centres. This KPI evaluates the energy consumption of an application platform prior to deployment. The purpose of this KPI is to measure the energy effectiveness of a set of target IT equipment, operating systems and middleware, to enable the selection of an energy effective IT stack.

This document specifies a formula for calculating APEE and definitions of components of the formula.

This document specifies a measurement method for assessing and reporting the energy effectiveness of an application platform.

This document also specifies requirements for benchmarks to be used for APEE and requirements for reporting.

The following topics are outside of the scope of this document:

1) KPIs intended to solely evaluate the energy effectiveness of target IT equipment hardware,

2) energy effectiveness of data centre facilities.

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.

ISO/IEC 21836:2020, *Information technology — Data centres — Server energy effectiveness metric*

ISO/IEC 21878, *Information technology — Security techniques — Security guidelines for design and implementation of virtualized servers*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 21878 and the following apply.

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

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

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

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3.1.1
application platform
platform composed of *target IT equipment* (3.1.4), operating systems, and *middleware* (3.1.3) with the purpose of providing an *IT service* (3.1.5)

Note 1 to entry: An application platform is an environment for executing *software applications* (3.1.2) such as ERP and CRM software. Therefore, a software application itself is not included as part of an application platform.

3.1.2
software application
computer program for implementing an *IT service* (3.1.5)

Note 1 to entry: A software application is usually developed independently for each IT service.

3.1.3
middleware
software layer between an operating system and the *software applications* (3.1.2)

Note 1 to entry: Examples of middleware include DBMS, web server software, application server software, transaction monitor.

Note 2 to entry: An operating system is the software directly managing the hardware, e.g. conventional operating system, hypervisor, etc.

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.2459, modified – Notes 1 and 2 to entry have been added.]

3.1.4
target IT equipment
server, storage and network equipment that are components of an *application platform* (3.1.1)

3.1.5
IT service
service that provides an outcome to its users via information technology

3.1.6
application outcome
information provided by an *IT service* (3.1.5) to its users

Note 1 to entry: An example of an application outcome is a set of reports to support decision-making at retail outlets (such as sales analysis reports, and stock status reports).

3.1.7
measurement period
duration in which the benchmark performs the intended data processing

Note 1 to entry: Typically, the measurement period(s) is/are the only portion of the benchmark execution which is/are used to calculate the benchmark score.

Note 2 to entry: The intended data processing routine is a routine including the benchmark calculation.

Note 3 to entry: In the case of using TPC-H[1)], the measurement target of TPC-H is a performance for executing SQL queries, so a period of executing SQL queries is a measurement period. Other periods, such as a data loading, are not a measurement period.

3.1.8
benchmark identifier
string which identifies a specific benchmark, which consists of the name and the major *version* (3.1.9), when applicable

1) TPC-H, TPC-E, and TPCx-IoT are trademarks of the Transaction Processing Performance Council. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO/IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

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3.1.9
version
particular form or variation of a resource that differs from other instantiations of the resource in at least one aspect or item of information

Note 1 to entry: The first digit of a version is called the major version, and any numbers right of that digit is called a minor version.

Note 2 to entry: Example: in the version designated as "v1.2.3," the Major Version identification is "1", and the Minor Version identification is "2.3".

[SOURCE: ISO 24619:2011, 3.1.9, modified — Notes 1 and 2 to entry added.]

3.1.10
internal power supply
independent device that converts commercial AC power to DC power as required inside *target IT equipment* (3.1.4)

3.2 Abbreviated terms

AC	alternating current
AI	artificial intelligence
APEE	application platform energy effectiveness
CRM	customer relationship management
DBMS	database management system
DC	direct current
EAP	energy consumption of application platform during the measurement periods
ERP	enterprise resource planning
FC	fibre channel
IoT	Internet of Things
NoAO	number of application outcomes during an APEE measurement
OS	operating system
RDBMS	relational database management system

4 Relevance of APEE

Many kinds of IT services are provided by using data centres, and it is necessary to conserve the amount of energy used by these IT services. A lot of IT services use various technologies, such as AI, IoT and big data technologies. For each of these technologies, there are several combinations of target IT equipment, OSs and middleware that can be used to provide IT services. These combinations of target IT equipment, OSs and middleware are called an application platform.

Even if the results provided by an IT service are the same, if the application platform used to provide the IT service is different, the energy consumption is also different. For example, when the same query is executed on different DBMSs, because the processing method and processing time are different for each DBMS, energy consumption also differs.

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