TECHNICAL REPORT

ISO/IEC TR 20913

First edition
2016-11-15

Information technology — Data centres — Guidelines on holistic investigation methodology for data centre key performance indicators

Technologies de l'information — Centres de données — Lignes directrices relatives à la méthodologie de recherche holistique pour les indicateurs de performance clé du centre de données

Reference number
ISO/IEC TR 20913:2016(E)

© ISO/IEC 2016



COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword ..... **iv**

Introduction ..... **v**

1 Scope **1**

2 Normative references **1**

3 Terms, definitions and abbreviated terms **1**
3.1 Terms and definitions 1
3.2 Abbreviated terms 2

4 Background and motivation **2**
4.1 General concept of holistic investigation method 2
4.2 Usefulness of spider web chart methods for visualizing data centre KPIs 3
4.3 Usefulness of aggregating data centre KPIs 4

5 Spider web chart-based KPIs status observation method **4**
5.1 Principles for constructing a spider web chart using KPIs 5
5.1.1 Selection of axis on a spider web chart 5
5.1.2 Presentation of KPIs on axes 5
5.2 Example of a holistic approach 5
5.3 Example of holistic approach of data centre by use of a spider web chart 6

6 Control chart method extending a basic spider web chart to observe the operational status **11**
6.1 Motivation for control chart method for energy efficiency monitoring 11
6.2 Control chart approach for energy efficiency monitoring 11

7 Considerations for applying holistic investigation methods **14**

8 SWOT analysis results for holistic investigation methods **14**

Bibliography **16**

© ISO/IEC 2016 – All rights reserved

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, SC 39, *Sustainability for and by Information Technology*.

© ISO/IEC 2016 – All rights reserved

Introduction

The ISO/IEC 30134 series defines key performance indicators (KPIs) for data centre resource effectiveness. There are many aspects to be considered in order to improve data centre resource effectiveness. As for resources, it may include not only energy, but also water and other natural resources. As for data centre components, they include air conditioning, power supply, servers, storages, and network equipment. However, it is difficult to include all aspects into one KPI, so multiple KPIs are under development, which measure each aspects of resource effectiveness improvement. Resource effectiveness improvement in each aspect will be performed by measuring each KPI. On the other hand, there is a need to observe the state and trend of data centre as a whole, or holistically, by monitoring multiple KPIs in a single view. Analysis of the KPIs from the overall perspective is also referred to as a holistic investigation method. This document describes a spider web chart-based method and control chart method extending the functionality of the conventional spider web chart for viewing and analysing KPIs for data centre resource effectiveness. It also investigates considerations for applying holistic investigation methods to resource effectiveness evaluation of multiple data centre KPIs. The usefulness and applicability of holistic methods are discussed using a SWOT analysis. The methods described in this document are intended for analysis and continuous improvement of a specific data centre and not for comparing different data centres.

© ISO/IEC 2016 – All rights reserved

Information technology — Data centres — Guidelines on holistic investigation methodology for data centre key performance indicators

1 Scope

This document describes backgrounds, motivation, and general concept of holistic methodology for data centre key performance indicators (KPIs) to investigate the status of KPIs. It discusses the usefulness of holistic investigation methodology in terms of aggregating a KPI across different contexts, aggregation of two or more KPIs within a single context, aggregation of two or more KPIs across multiple contexts, and aggregation of the multiple KPIs into a single indicator. This document presents a conventional spider web chart-based data centre KPIs status observation method and a control chart method including upper bound and lower bound of the operational status of KPIs. This document presents SWOT analysis results for both methodologies. The methods described in this document are aimed at the self-monitoring of a data centre, not comparison among data centres.

Specifically, this document

a) describes backgrounds, motivation, and general concept of holistic investigation methodology for data centre KPIs,

b) analyses the usefulness of holistic investigation methodology for aggregating KPIs,

c) describes a spider web chart-based KPIs status observation method and a control chart extending spider web chart to observe the operational status of KPIs,

d) describes alternative and/or additional methods of representing dissimilar KPIs to track holistic resource effectiveness of the data centre, and

e) presents SWOT analysis results for holistic investigation methods described in this document.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

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

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

3.1.1
holistic investigation method
data centre resource effectiveness investigation method considering multiple key performance indicators

© ISO/IEC 2016 – All rights reserved

3.1.2
spider web chart
chart that consists of multiple performance indicators which are set in a circle like a spider web

3.2 Abbreviated terms

IT	Information Technology
ITEEsv	IT Equipment Energy Efficiency for Servers
ITEUsv	IT Equipment Utilization for Servers
KPI	Key Performance Indicator
PUE	Power Usage Effectiveness
REF	Renewable Energy Factor
SWOT	Strength Weakness Opportunity Threat

4 Background and motivation

4.1 General concept of holistic investigation method

Improving the resource effectiveness and carbon footprint of a data centre requires the monitoring and analysis of multiple KPIs. ISO/IEC JTC 1/SC 39 has determined that it is impractical to aggregate multiple KPIs to determine the overall energy effectiveness of a data centre. There is a need to observe the state and trend of multiple KPIs in a single view.

With any performance indicator, it is necessary to understand the expected upper and lower limits and general behaviour of the performance indicator. There are typically two approaches that are applicable to holistic investigation of data centre KPIs:

— Engineering/modeling method: This method has been used to establish baseline performance. This methodology requires the development of an optimized economic and engineering model based on creating an idealized benchmark specific to each utility — incorporating the topology, demand patterns, and population density of the service territory. Typical limitations of this approach are as follows: the engineering models that support it can be very complicated, and the structure of the underlying components relationships can be obscured through a set of assumed coefficients used in the optimization process.

— Performance benchmarking method: This method includes a set of specific performance measurement indicators, such as volume billed per worker, consumed energy per product, quality of service (continuity, water quality, complaints), coverage, and key financial data. Usually, these indicators are presented in ratio form to control the scale of operations. These partial measures are generally available and provide the simplest way to perform comparisons: trends direct attention to potential problem areas.

Among the methods mentioned above, the performance benchmarking method is useful for evaluating the resource efficiency of data centres because ISO/IEC JTC 1/SC 39 is offering a selection of energy effectiveness KPIs. The performance benchmarking method may be further categorized into two types: performance indicator-based methods and chart-based methods.

— Performance indicator-based methods: In this category, the performance of the target is evaluated by developing performance indicators for the target. For example, Hz for CPU and bytes for storage are typical performance indicators. This category allows accurate performance evaluation and comparison among targets, if the performance indicators are defined. Typical limitation of this approach is that it is difficult to compare the evaluation results if performance indicators belong to different dimensions with different units.

© ISO/IEC 2016 – All rights reserved