Erick Butler POLETTO
Ricardo Alexandre FIORELLI

Data Center Energy Efficiency: Analysis and Test of Energy Consumption Benchmark Tools

Milan – IT

Academic Year 2007-2009

Erick Butler POLETTO
Ricardo Alexandre FIORELLI

Efficienza Energetica dei Data Center: Analisi e Verifica dei Tool di Benchmark dei Consumi

Tesi di Laurea

Orientator: Prof.ssa Chiara FRANCALANCI

Laurea Specialistica in Ingegneria Informatica
Dipartimento di Elettronica ed Informazione (DEI)
Politecnico di Milano

Milan – IT

Anno Accademico 2007-2009

Acknowledgements

"It's the only home we know. Yet everyday, we take the earth for granted.
Everytime we leave the lights on, we are doing the earth harm.
When we forget to turn off our computers, energy is also wasted.
But together we can help make the world a greener place, one simple act at a time.
Because when it comes to the environment, small changes can make a world of difference.", ***The "Power To Change" manifest***

Questions and Doubts

In order not to have any text not related to the thesis in the middle of the text and maybe, in the final version nobody sees it, I created this file, like that, we can put some information here and delete it in the last version. Of course, these are not the only issues related to the thesis, but it is better to have a centralized way to do that.

The questions are:

Section ?? or Appendix ?? Do we need to insert all tables here, in appendix, or where do we need to insert the tables? Or just the database schema? These tables were taken from the SANDRA Access file.

Section ?? special attention to the schema of the database with measures with the measurement tool provided.

Figure ?? Can we insert a picture with the Toms hardware logo, or do we need to port it and provide the source?

Figure ?? same as above.

referencia a formula 1 In order not to have any text not related to the thesis in the middle of the text and maybe, in the final version nobody sees it, I created this file, like that, we can put some information here and delete it in the last version. Of course, these are not the only issues related to the thesis, but it is better to have a centralized way to do that.

$$\begin{aligned}\text{monitor power consumption } = &\text{ power measured with monitor on and idle processor } - \\ &\text{power measured with monitor off and idle processor}\end{aligned} \tag{1}$$

In order not to have any text not related to the thesis in the middle of the text and maybe, in the final version nobody sees it, I created this file, like that, we can put some

information here and delete it in the last version. Of course, these are not the only issues related to the thesis, but it is better to have a centralized way to do that.

Glossary of Abrevitations

x	x
ALU	Arithmetic Logic Unit
CIO	Chief Information Officer
CPU	Central Processing Unit
DDR	Double-Data Rate
FPU	Floating Point Unit
HVAC	
HDD	Hard-disk Drive
ICT	Information and Communcation Technology
LTO	Linear Tape-Open
MFD	Multi Function Devices
MPN	Manufacturer Part Number
OS	Operational System
PC	Personal Computer
PDU	
PSU	Power Supply Unit
RAID	
ROI	Return on Investment
ROM	Read-Only Memory
SaaS	Software as a Service
SDRAM	Synchronous Dynamic Random Access Memory
SAN	Storage-Area Networks
TCO	Total Cost of Ownership
VM	Virtual Machine
VPN	Virtual Private Network
x	x

Abstract

Sumário

Lista de Figuras

Lista de Tabelas

1 Conclusions

This chapter summarizes the main findings of this study and draws out their support for applying a green solution. It thereby aims to enrich the understanding of the method and the valuable information that can be extracted from this database.

The use of *green ict* applied to data centers can be a very useful strategy in different scenarios. Using the database of components resulted from this thesis work it can be very effective for what it is proposed to be: offering a way to compare the energy consumption of the computer components in one single place. The present is intended to be a

Perspectives and Future Developments

Suggestions for future developments, there are

-
-
-
-
-

Referências

ANTONOPOULOS, A. M. What can virtualization bring to the data center? *Network World*, September 2005.

BAILEY. What are the difference between servers? *XENON*, 2009.

BRYMAN, A. *Research Methods and Organization Studies*. [S.l.]: Routledge, 1989. ISBN 0415084040.

CHESTNEY, N. *IT industry joins energy efficiency push*. jan. 2009. `http://www.reuters.com/article/technologyNews/idUSTRE50R4AL20090129`.

COOKE, D. *Power Distribution within Six PCs*. jun. 2009. `http://www.silentpcreview.com/article265-page1.html`.

GOLDWORM, B. *Blade Servers and Virtualization*. [S.l.]: Wiley-India, 2007. ISBN 8126512156, 9788126512157.

HENDERSON, T. Blade servers vs. rack servers. *Network World*, 2007.

HETHERINGTON, R. *The UltraSPARC T1 Processor - Power Efficient Throughput Computing*. [S.l.], December 2005.

HP. *HP Modular Cooling System: water cooling technology for high-density server installations*. [S.l.], April 2007.

IDC. Enterprise class virtualization 2.0 application mobility, recovery, and management. February 2007.

INFO-TECH. *Info-Tech's Green Index: How Green Are You?* [S.l.], July 2007.

KUMAR, R. Eight critical forces shape enterprise data center strategies. *Gartner, Inc.*, February 2007.

MAKHIJA, V. *VMmark: A scalable benchmark for virtualized systems*. [S.l.], September 2006.

REHN, R. What else do you know about blade servers. *Hospedagem Local*, 2008.

REINE, D. *Disk and Tape Square Off Again - Tape Remains King of the Hill with LTO-4*. [S.l.], October 2008.

STAMFORD, C. Agility will become the primary measure of data centre excellence by 2012. *Gartner, Inc.*, October 2007.

TOWNSEND, M. *Earth 'will expire by 2050'*. jul. 2002. `http://www.guardian.co.uk/uk/2002/jul/07/research.waste`.