Green IT in datacenter for small and medium sized companies

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1. Initial situation

It wasn’t until 1992 in Rio de Janeiro that the sustainable discussion started, but it still lasts to today. This topic is that much important, that our children and the children of their children will work and act with the main principles of sustainability in their mind. When we look at companies today, there is a large trend identifiable: Over the last five to seven years, the meaning of resource management has increased. Especially the awareness and consciousness towards the use of material and energy in enterprises has increased. In course of this discussion the demand for a Green IT raised. One of the main objectives were to reduce the power consumption of business information and telecommunication-systems and that they should work more efficiently.

In large data centres there are different possibilities to reduce energy consumption. There are the possibilities to use new technologies, train the employees in a special way or to adjust sequences and processes. In small companies there are less possibilities to optimize energy consumption. This is caused by the initial costs every action (method) will take and the slower amortization. Therefore many smaller companies don't tend to follow a sustainable way of production and can't reach advantages in saving emissions or energy consumption.

Another problem is that most companies don't have any registers for technical devices.

In the period of purchasing, electronic devices are registered by the tax-system, but there is no meta data stored for energy consumption. Therefore almost all SME have a black or grey box about their electronic devices and power consumption.

The calculation for energy consumption doesn't list each device or parameter but the sum of all devices. This includes electricity like light sources, server, switches, monitors, telephones, printer and so on.

So, on the electric meter the load of the whole hardware is displayed. The particular consumption of any device is mostly unknown and devices with enormously power consumption will not be identified and therefore cannot be substituted.

2. Overview

To increase energy efficiency in data centres, regardless of their size, it is necessary to create a register of all energy consumptions. It should hold all data regarding the operation time and the corresponding energy consumption.

Especially the update process must be executed in a cyclic interval, to be able to add new components and their consumption, without corrupting the overall balance.

The controlled energy consumers can be divided into different categories. Such as:

- IT,
- IT-infrastructure,
- Infrastructure of building etc.

In these categories, the possibility to access data regarding energy consumption is differently solved.

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IT-Components like firewalls, switches or server, are often holding measuring instruments, which are seldom used. Also, there is no standard software which is able to collect all relevant data and to create appropriate reports. If an IT-component has no integrated measuring system, it has to be identified separately. In this case, it is important to distinguish between components with constant or rather fluctuating load. The operating time of each component is also relevant. If a consumer has a constant load with calculable operating time, it can be measured once and incorporated by the energy calculation as constant value. Consumers with fluctuating energy load, must get a load monitoring system, introduced by a third party supplier. One possibility would be, to install special power distribution units (PDO), which are looking like a multiple socket with integrated load measurement system. The generated data can be fetched and displayed by correspondent software.

The data gathering from components which are in need of direct power access and no need of sockets, is more difficult. One example is an air-conditioning systems. These systems offer usually only proprietary interfaces or none. Since there is a time-delayed feedback, between the server load and thermal output, which is to be compensated by the air conditioning, operator of data center often use an allocation formula. To be able to calculate the power consumption for an air conditioning unit, it is necessary to multiply the power consumption of the correspondent server rack with the factor 1.5.

\[ E_{\text{cooling}} = E_{\text{Rack}} + \frac{E_{\text{Rack}}}{2} \]

If the components aren't offering any measuring units and the possibility to measure the load beforehand is abandoned, the only way to account the power consumption, is to do it in a sweeping way. This way is used by older data center, which are calculating that a huge amount of the power consumption is used for cooling. The expenses are divided by all consumers. All allocation formula like this are tools to apportion charges, but cannot help to locate saving potentials or to increase power efficiency.

Another challenge for a complete and consistent analysis are devices, which aren't registered by the accounting department. For instance expensed server, which were reactivated for testing purposes. Also there is the difficulty of devices, imported by employees. This consumers, like water boiler, coffee maker or freezer, can be identified within an inspection in a review process. More difficult is the
registration of devices, which are only temporarily connected to energy sources like smartphones, mobiles and so on.

3. Concept

To advance the current activities in reducing energy consumption, carbon emission and last but not least expenses, it is necessary to develop a software tool, which can be used by small and medium sized companies (SMEs) to optimize the areas addressed above.

Within our project we are going to develop a software, which will (in the first milestone) support attempts to reduce energy consumption in datacenter for SMEs. We want to transform the blackbox, which has no information on devices or data, into a glass box. That is the basis assessment to be able to find the right management decisions. Our ambition is to catch most relevant data automatically, analyse the consumption of energy for nearly each device in use and to create meaningful reports and solutions.

![Figure 2](image)

The report will help to optimize, replace or substitute e.g. IT-hardware. Furthermore, the generated list of discovered hardware will support manual adjustment. Therefore the evaluation will include the whole IT-landscape.

All devices, which are connected to the company network, will be discovered automatically by the monitoring system. It will test the accessibility and correct working of every component in the company network in a fixed time interval. This is a very important part of the application. After each cycle, the monitoring system will send the collected data to a energy controlling system, which will take care of the saving process.

All devices, which are found are examined for an energy measuring unit automatically. If there is one, there will be a message to the user, that a new component was found and that the measuring unit is integrated into the system.

Devices without integrated measuring unit or devices which aren't connected to the network can be measured if they are powered by a PDU. The software will connect to the PDU within an auto discovery
mode and will start a wizard which guides the user to create a new device within the software. After this procedure, the PDU and the device are permanently connected.

All components, which cannot or should not registered automatically, can be integrated manually. It is possible to save a static power consumption for a specific accounting period for these devices. The software will make a power consumption register available, which will be nourished by a community. Therefore it will not be necessary to administer each component. Afterwards the data collection will be updated by the system automatically.

The last possible devices, which can be saved within the system are devices which are used periodically or have a variable energy load. If the optional installation of a PDU is abandoned, there has to be a local measuring unit (which are reasonably priced) installed. In this case, the system assists the user by sending emails or saving appointing to read the data within a calendar.

All generated data, power consumptions and results will be saved in a database. Therefore all data is easily accessible and can be compared to itself, estimations or calculations. Another important aspect is, that devices which tend to use a lot of energy can be identified easily. As soon as the input is finished, the report generator is able to create a list of all devices, which shows current energy consumption. The next step is a special report, which shows and compares the consumption, so that consumers with large power consumption can be spotted without much effort.

Using the software will also reduce administrative and temporal expenses. Users will work with an intuitive interface and won't need a special user training. Alternatively the training can be executed on demand. The menu is meaningful but simple. All commands (menu commands) are following the widely known menu pattern, so that a menu entry will exist at a point where a user is expecting it. If a process or task of the application is lasting more than 20 seconds, the user will get information about the current status and the estimated remaining time period. Beyond that, there are several instructions like manuals, an online help and training/tutorial videos.

4. Technical transformation

Parts of the application will be offered as a „Software as a Service“ (SaaS). Therefore a company doesn't need special software and a web browser like Internet Explorer, Firefox, Chromium, Opera, Safari, etc. is sufficient. Additionally a local installation, maintenance, updates, backups or other efforts are not needed. The main advantage, that the application is platform-independent, is due to this SaaS approach. The software is hosted on a web server and will communicate with the application through an encoded SSL or TSL connection. Furthermore, the application will be developed in an object orientated programming language like Java, PHP or Python. To be able to interact with the user dynamically and to achieve a desktop like user experience, the software will use and depend on AJAX techniques and technology.

Since the software will only use Open Source Software (OSS), the application can be installed and integrated for free in any company, except for the time it takes to incorporate and administrate it. With the help of special interfaces for data-import and -export, the power consumption data will be recorded automatically. Therefore all data reflects the real-time energy consumption. The software consists of one main framework and several plugins depending on the server environment. Additionally there will be an implementation for remote access. This ensures that the ability to check the current power consumption, adapt the parameter or to control the server, printer or any other device, even if the administrator has no direct access to the machine, will be ensured.
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