Netherlands Enterprise Agency

Happy Flow manual 1.0

Energy-efficient design of data centres using power management and virtualisation

Lower Energy Acceleration Program (LEAP) commissioned by the Netherlands Enterprise Agency
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» Sustainable, Agricultural, Innovative and International Enterprise

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Significant energy savings from improved energy efficiency

The exchange and storage of data is increasing as a result of the digitisation of society. This causes the demand for electrical energy to rise too, even though the objective of the Energy Transition (part of the Climate Agreement) is energy conservation. There are many data servers and data centres in the Netherlands that rarely operate at full capacity while they constantly consume a great deal of energy. This is why there is a need to improve their energy efficiency. We are doing this as part of the Lower Energy Acceleration Program (LEAP): stimulating the energy-efficient design of data centres so that their energy consumption is optimal in relation to the server load. This is not the case in many (organisations with) data centres although these are easy pickings. In other words: more efficient energy consumption is relatively easy to achieve because relatively simple adjustments of the server settings – such as configuring power management and/or virtualisation of your servers – allow significant energy savings to be achieved without loss of speed or reduced performance.

What is it?

This manual will also make it easy to reduce the energy consumed by your server(s). It will tell you what you can do, how to do it and provide answers to frequently asked questions. You can also find a number of practical examples of businesses that preceded you, such as Amsterdam Airport Schiphol, where 10-13% energy savings were achieved using different server settings. The North Sea Canal Area Environment Agency is saving as much as 14% using the modified settings.

Who is it for?

This Happy Flow Manual 1.0 is intended for all organisations that have data servers, in their own offices or in a data centre, who want to work in a more energy-efficient way. The paragraph covering the question 'Why?' has been written for ICT managers, those responsible for CSR and similar staff. The paragraph 'What can you do?' and onwards is intended for system administrators and operations managers. Hardware suppliers can use this manual to inform and advise their clients.

By whom?

This document was developed in collaboration with DELL, HPE, IBM, VMware and Red Hat. The collaboration between these leading suppliers of hardware and virtualisation software emphasises the importance of technology for power management and the trust they place in it. Version 2.0 will include information from the following LEAP research tracks.

Glossary of terms for non-ICT professions

- **Power management (energy management):** the settings on a computer/server used to regulate the energy that is required; for example to use less energy when the load on the server is low.
- **Virtualisation:** having several operating systems run on a single computer/server, which allows several tasks to be performed for several users on a single server.

Why has this Happy Flow manual been written?

ICT energy-efficiency programs have made great strides in the Netherlands over the last decade, one example being the significant improvement in PUE (Power Usage Effectiveness) of the data centres. This means that most data centres now handle their energy consumption very efficiently. The manufacturers of ICT hardware have continued the development of servers, storage and network equipment making them more efficient. This means that the servers and equipment can do more using the same amount of energy. In addition to this, servers in particular have been widely provided with functions allowing the energy consumption of these machines to be adjusted to the workload. This presents many opportunities to have servers run as efficiently as possible.

Still many gains to be made

The energy consumption of the ICT sector in the Netherlands is not falling however; it is rising sharply. This is partly due to an enormous increase in the use of ICT services. The demand for ICT services is not constant: use during the day is much greater than at night. Despite this, consumption by many data centres is fairly constant. In other words: the equipment operates at a high level continuously while this is only necessary at the 'busiest' times of day. Therefore, there are significant gains to be made here.

Amsterdam Airport Schiphol

Amsterdam Airport Schiphol has a diverse IT park, including local servers, DC servers and cloud solutions. In a pilot, changes to the power management services delivered energy savings up to 13%, depending on the load and function of the server. It's a minor effort that yields great results. You can read the article about Amsterdam Airport Schiphol under 'Good examples from practice' on page 14.

Research into energy consumption by data centres

All ICT equipment is equipped with technology that the user can employ to tailor energy consumption to demand. This is why, in a pilot, the LEAP core team investigated the extent to which this technology was already used by a group of companies and how much energy they could save if they were to use this technology. The main findings of this pilot were:

- Most of those who responded have their servers configured in a dynamic energy mode. In these modes, the energy consumed by the servers concerned depends on the workload.
- All of those who responded use some form of the high performance setting by default.
- Many of those who responded use conflicting settings at the BIOS and OS levels.
- If the company configures power management to modes that save more energy, this results in energy savings of approximately 10% on busy server hubs. No detrimental effects for performance were reported during testing of these energy conservation modes.
- Switching from a static to a dynamic configuration for high performance does not automatically lead to energy savings for a single server but can result in savings for an entire cluster of machines.
- Even the busiest of servers expend more than one third of their energy consumption on idle cycles (repetitive processes performed by a processor while waiting for the start time of the next task), while this is almost 99% for the least busy servers.
- Many companies use a number of servers to process a specific amount of work in a virtual environment. We usually see servers operating at a low load. Removing one or more servers from the cluster can increase the load and therefore achieve lower energy consumption for the cluster as a whole. This saving is usually greater than when considering a single server. However, in that case you must ensure that sufficient other resources are available, such as memory and I/O performance.

Conclusions of the research

One of the conclusions is that virtualisation has an enormous effect on energy efficiency. The best opportunities can, in particular, be found in servers that are severely underutilised. Virtualisation and consolidation (combining tasks on fewer servers) of ten or more of these underutilised servers can easily be done and results in much higher energy

savings than by simply using power management on each individual server. Moreover, it results in financial savings and reduced use of critical materials. In short, these techniques mean that certain servers perform more work as a result of which fewer physical servers need to be operating in a data centre.

Another conclusion is that companies have too little knowledge of the role of virtualisation and power management in relation to costs and energy consumption. Moreover, they have little faith in the technology. This results in a great deal of inefficiency in the design and the management of servers, storage, and network equipment. There is a pressing need for clear guidance and instructions on the best way of using power management settings in combination with virtualisation.

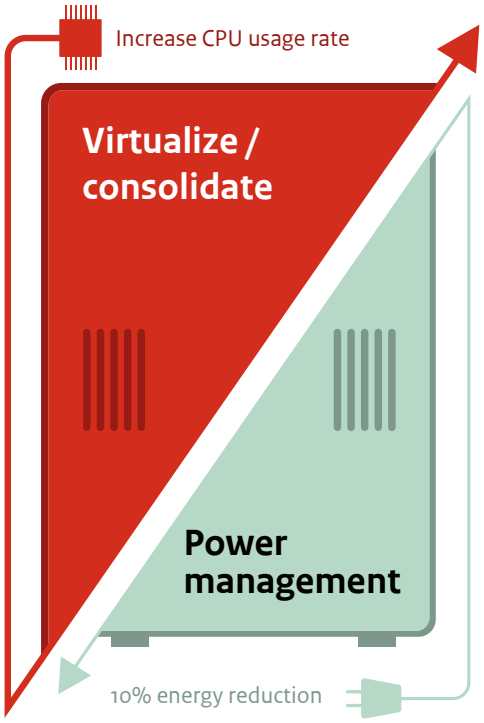
Energy conservation obligation

Pursuant to the Climate Agreement, there is a requirement to conserve energy. Companies with a great deal of data traffic are becoming more aware of this and are assuming responsibility for becoming more energy-efficient. Indeed, data centres that consume a great deal of energy fall under the Environmental Management Activities Decree (Activiteitenbesluit) in the Netherlands. This means that they are subject to an energy efficiency notification obligation. Virtualisation and power management are recognised measures for conserving energy here. For more information see the Recognised Energy Efficiency Measures List (EML: *Erkende Maatregelenlijst*) for offices and commercial data centres:

- For offices: Recognised Energy Efficiency Measures List for offices. See FG1 and FG5.
- For commercial data centres: Recognised Energy Efficiency Measures List for commercial data centres. See FD1.

KPN

One of the main changes made by KPN was activating the eco mode, yielding a 7% energy saving. This went unnoticed by KPN's employees because there was no change in the performance of the low-profile server.
You can read the article about KPN under 'Good examples from practice' on page 16.



What can you do?

One of the changes that you can make is known as 'power management'. These are settings that ensure that electrical energy consumption automatically adjusts to the workload at that time. Although the actual power management is done by the hardware, but you – as system administrator or operations manager – can adjust the power management settings. You have complete control of the scope of the settings. You may be familiar with this technology from the use of laptops (battery settings) where there is significant scope for minimising battery use. Similar technology can be found in servers.
You will find links to information from suppliers about the power management settings for servers under 'Implementation' later in this manual. You can exercise control in two ways:

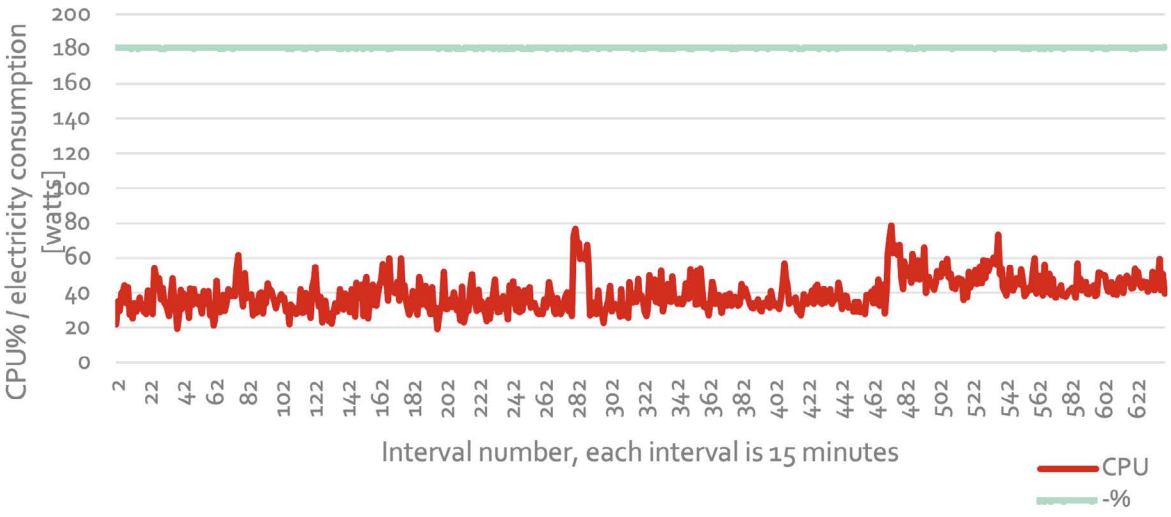
1. At hardware level using BIOS settings (*physical deployment*).
2. At operating system level (through virtualisation) using software settings (*virtual deployment*).

We recommend choosing just one of the two methods, since there is no server downtime when switching between settings within a single control method; for example when switching between different energy settings ('high performance', 'balanced' and 'power saving') in the BIOS. The same applies to switching within the operating system. Changing the control method does however require restarting the server. This leads to downtime.

Rabobank
The Rabobank uses the Dynamic OS control mode because the eco mode turns off the server, which is not what they required. Tests demonstrated that the Rabobank's energy consumption is already as efficient as possible. The challenge is therefore to find the optimal balance between performance and energy efficiency, where performance is leading because the client expects this. You can read the article about the Rabobank under 'Good examples from practice' on page 17.

The graphs below show the difference between the static high performance setting and variable energy consumption controlled by the operating system (OS). Both of the graphs below show the consumption in watts as well as and the processor (CPU) load in percentages. High performance settings (green line) produce the most predictable behaviour in computing power. All processor cores run at what is known as nominal frequency. However, they do not achieve their highest frequency (turbo) in this way. In this case there is no relationship between energy consumption and workload.

High Performance

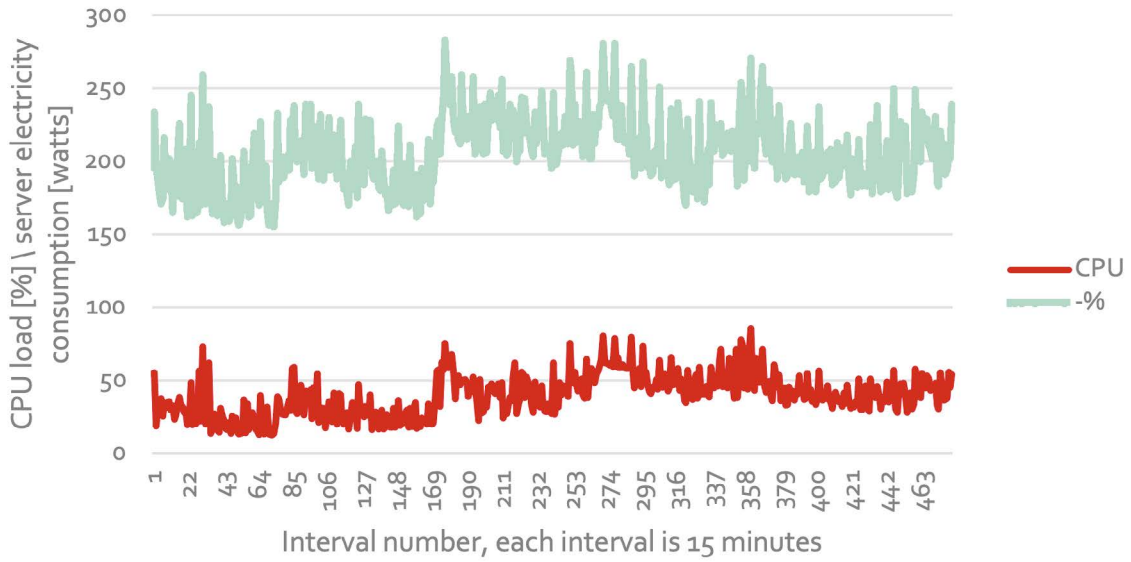


North Sea Canal Area Environment Agency

The North Sea Canal Area Environment Agency has three modestly sized servers in Zaandam. The power settings were set to high performance. Following measurements, they were set to balanced, producing a 14% energy saving for the service each working day, without reduced performance. You can read the article about the North Sea Canal Area Environment Agency under 'Good examples from practice' on page 19.

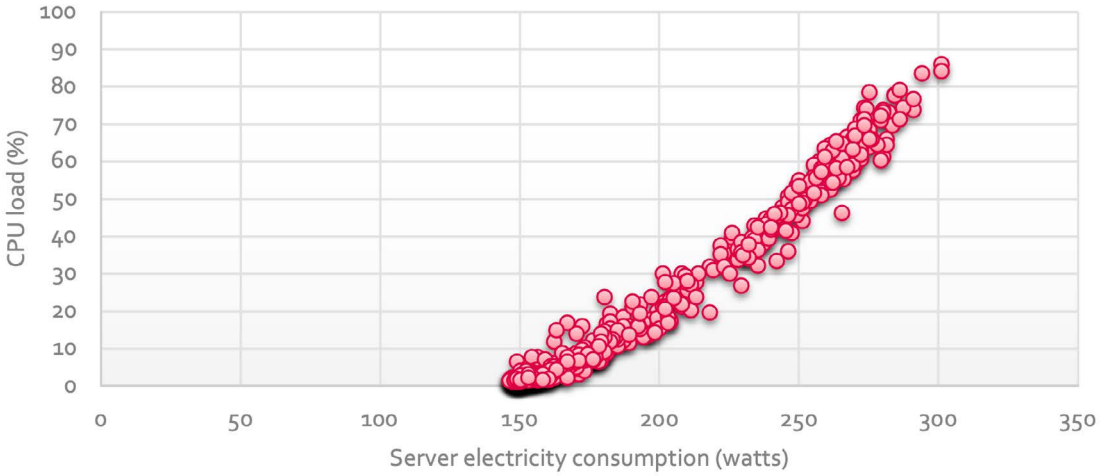
A relationship can be distinguished between power consumption and workload when the energy consumption is managed by the operating system. This is not the case when the energy consumption is managed by the operating system. This can be seen from the graph below. The power adapts to the workload. Here, a high CPU load causes the server to draw more electrical power than under the static setting, an indication that dynamic servers also deliver more computing power when necessary.

Managed by the OS



The dynamic settings do not have a negative effect on the server's maximum computing power. They only reduce the CPU frequencies if the demand for computing power is low. The power consumption is directly related to the workload when a server displays the desired dynamic behaviour. The graph below shows the greater the load on the processor, the higher the power consumption. This dynamic depends on the server configuration. Both the steepness of the line and the minimum consumption by the server while it is doing nothing (*Pidle*) are affected by the power management settings.

Server electricity consumption versus CPU load
-> Pidle = 150 W



Happy Flow Instructions

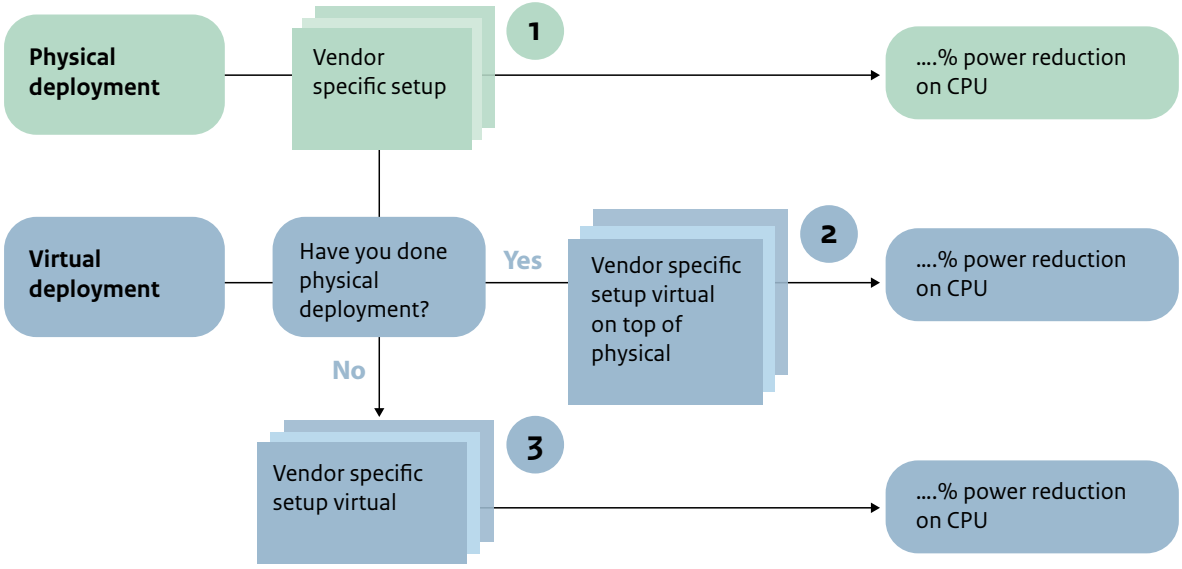
This manual sets out three flows (*methods*):
1. Physical implementation of the server hardware. This refers to a supplier-specific document.
2. A hybrid implementation, where both physical and virtual power management are used.
3. A fully virtual power management system where the physical installation is set to the minimum requirements and all power management takes place at hypervisor level (the level that controls virtual machines; this can be hardware, firmware or software).

The following pages contain a table, per flow, with links to a. instructions for detailed information about the practical application of power management and b. whitepapers for a summary of the possibilities. Read the documentation from your supplier to obtain certainty about the most suitable option. When doing so remember that this is not a static manual: it is under development. Check the supplier's website to see if a newer version is available.

Happy Flow

Are you looking for the most suitable flow for your specific situation, better known as the 'Happy Flow'? The diagram below can help you here.

Suggestion for anyone using a hypervisor: start at flow 3 because the power management of the hypervisor offers more options and there is less downtime when those options are used.



Implementation

Physical implementation

Vendor	Instructions	Whitepaper
HPE	The document sets out how to handle power settings on the servers. The 'BIOS/ Platform Configuration Options' section includes the 'Workload Profiles and Performance Options' section. You can select a default workload there, for example: • General Power Efficient Compute (default) • High Performance Compute (HPC) • Virtualisation - Power Efficient. Set these for a default Vmware environment • Virtualisation - Max Performance This optimises the setting for that type of workload. It also includes all further details. In practice, it is the right (default) setting for servers that are virtualised. It is advisable to make the changes as above for a virtualised environment.	• https://support.hpe.com/hpesc/public/docDisplay?docId=a00016407en_us
DELL	On the DELL EMC PowerEdge Servers, the 'System Profile' can be adjusted in the BIOS or iDRAC. See System Profile Settings detail: https://dl.dell.com/topicspdf/idrac9-lifecycle-controller-v31-series_users-guide4_en-us.pdf If a '1:Many management console' is used, such as OpenManage Enterprise, rollout to several servers is possible using a Compliance Template. See: Managing the device configuration compliance: https://www.dell.com/support/manuals/nl-nl/dell-openmanage-enterprise/ome_3.5_ug/managing-the-device-configuration-compliance?guid=guid-7cd1ffde-ead5-45ed-8440-ae-a4a527f708&lang=en-us • BIOS Performance and Power Tuning Guidelines for Dell PowerEdge 12th Generation Servers • Dell EMC OpenManage Enterprise	• PE_intergenerational_energy_efficiency_v1p1 • SystemProfileEnergyPerformanceComparison_v1p0.pdf
IBM	See the instructions via the link in Red Book.	Redbook (search for power management / virtualisatie)

Virtual on top of physical implementation

Vendor	Instructions	Whitepaper
VMware		
Generic	See instruction in 'Virtual Deployment'	See whitepaper in 'Virtual Deployment'
HPE	The short document mentioned sets out how the power settings can be made. The preference is to select a Workload profile and then have the OS manage it further.	HPE ProLiant Server Power Management Red Hat Enterprise Linux 6.x and 7.x and SUSE Linux Enterprise Server 11, 12, and 15 a00020432ENW, August 2018, Rev. 1 https://h50146.www5.hpe.com/products/software/oe/linux/mainstream/support/whitepaper/pdfs/a00020432enw-2018.pdf HPE ProLiant Server Power Management Red Hat Enterprise Linux 6.x and 7.x and SUSE Linux Enterprise Server 11 and 12 a00020432ENW, July 2017 https://h50146.www5.hpe.com/products/software/oe/linux/mainstream/support/whitepaper/pdfs/a00020432enw.pdf

Virtual implementation

Vendor	Instructions	Whitepaper	Videos and pressos
VMware	Generic recommendations for BIOS: • Ensure latest BIOS version from HW manufacturer • Ensure all sockets, cores and Hyperthreading enabled • Enable 'Turbo Boost' • Enable NUMA • Enable HW assist functions: VT-x, AMD-V, EPT, RVI, etc. • Bios power management in 'OS controlled mode' • Enable all C-states in BIOS • Disable unused devices and ports in BIOS • Changing these might require a reboot Generic recommendations for Power Setting in vSphere: Leave the default power setting (Balanced) which leverages Turbo Mode • Change to High Performance **only** if you have large (+8vCPU) workloads or extremely latency sensitive workloads such as real time audio and video apps. • If powers saving is a higher priority than performance, select Low Power • Custom for those who understand this well enough to adjust individual settings • Changing these setting do not require a reboot • Check availability of Power Management in vSphere Client under Host, Configure, Hardware, Power Management, Technology to see what power management is available to the system. So best advice to save power is to maximise your consolidation density. The VMworld video of 2020 is your best source of knowledge. If you happen to have an environment with very low utilisation on different times, consider using DPM which puts hosts of a cluster in sleep mode when there is excessive capacity. This gives huge power savings with long latency to power back up. There are scheduling functions available.	https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpaper/performance/vsphere-esxi-vcenter-server-70-performance-best-practices.pdf https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpaper/performance/vsphere-esxi-vcenter-server-67U2-performance-best-practices.pdf DPM page 108 https://docs.vmware.com/en/VMware-vSphere/7.0/vsphere-esxi-vcenter-server-701-resource-management-guide.pdf	https://youtu.be/EYggYAwjz3g?t=867 Gives a good explanation of the Turbo mode, a way to measure power management impact Then gives the wrong advice to switch to High Performance this is rectified in the 2019& 2020 session. Extreme Performance Series: Efficient, Sustainable and Performant: Have Your Cake and Eat It, Too PDF version accessible without account. https://static.rainfocus.com/vmware/vmworld2020/ Video of the above PDF of vmworld 2020 accessible with an account is the best usage of one hour of your time. https://www.vmworld.com/en/video-library/video-landing.html?sessionid=1589494936581740015kyosess/1589493658174001Skyosess/1589493658174001Skyo/PDF/HCP2232_FINAL_1600286219820001Jtp0.pdf

Vendor	Instructions	Whitepaper	Videos and pressos
Red Hat (*)	Customers can set the energy consumption as needed, based on Performance and Power saving targets. Amongst others, tools like **tuned** and **powertop** are obvious to start with. A comprehensive set of tools and instructions can be found at: https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html-single/monitoring_and_managing_system_status_and_performance/index https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/8/html/monitoring_and_managing_system_status_and_performance/managing-power-consumption-with-powertop_monitoring-and-managing-system-status-and-performance If you have any questions or need help, please issue a request at https://access.redhat.com/	• monitoring_and_managing_system_status_and_performance • monitoring_and_managing_system_status_and_performance/managing-power-consumption-with-powertop_monitoring-and-managing-system-status-and-performance	

(*) The powersave tuned profile will adjust settings on x86_64 boxes to consume less power. However, doing so may have effects on the applications running on those boxes as well. Prior to making this decision for boxes, it is recommended that customers benchmark their systems using something like throughput-performance and again after switching to powersave. That way they can have reasonable expectations on what this change may mean for their compute needs.

Frequently asked questions

When, how often and how long is peak performance required?

Average CPU loads of above 70% occur very rarely. Power saving mode is not recommended for prolonged use at this level. A balanced profile can still be beneficial, as the profile does not reduce the maximum computing power; since CPU usage generally fluctuates, the technology can still conserve energy whenever loads drop.

Will customers notice reduced CPU performance because of energy conservation?

This is highly unlikely for the following reasons:

- Application performance is only partially determined by the CPU: networks, memory, data storage and other elements all contribute. In most cases, networks and storage systems are slower than milliseconds, and show commensurate variation in their performance.
- The human brain is incapable of perceiving differences of thousandths of a second (milliseconds), let alone millionths of a second (microseconds). If someone uses an application remotely via the internet, their network packages will have a much longer processing time (10 ms or more) with higher fluctuations in processing speed.

In some situations, reduced performance may be noticeable. See also below under 'When is power management not recommended?'

- Computers work in increments of one-third to half of a nanosecond (i.e. one billionth of a second), so a difference of several microseconds may very well be detected between two machines. In other words: a computer does notice this difference but it cannot be detected by humans.
- The highest turbo frequencies are not available in power saving mode. This means that a processor cannot achieve its absolute maximum speed. As a result, the response time of a server under that setting can be several milliseconds longer and the maximum computing power somewhat lower than under the high performance and balanced settings.

What can you expect from a dynamic setting for energy conservation in relation to computing power and energy savings?

With a dynamic setting, the peak power of a server is usually higher than when the same server is set to high performance. This is because the server with a dynamic setting can access a processor's turbo mode which it cannot do under a static setting. Where the demand for computing power is high, the server therefore consumes more energy but also delivers higher performance.

When the CPU load is low, energy consumption is just below the consumption under a static setting. On average, dynamic settings thus consume less energy when the CPU load is low, while when the CPU load is high, users benefit from higher computing power, facilitating the further consolidation of servers. This requires greater effort from the system administrator, but ultimately also conserves energy.

Also see the graphs under 'What can you do?'

When is power management not recommended?

Power management is a collective term for multiple technologies and is therefore a matter of finding the right settings. High performance settings are only preferable to 'balanced' or 'power saving' mode in a limited number of cases. High performance mode prevents CPU cores from entering higher C-states, which is to say that all CPU cores remain active all the time. This is desirable when fast and consistent response times are required. Note that this is not a reference to the computing power of the server, but rather to the response time to a command, even when the CPU load on the server is low. These types of situations do occur in high-performance computing (HPC), for example, where RAM from multiple servers is merged across special networks. In the financial world, too, where artificial intelligence (AI) is used for trading stocks, a delay of a millisecond can be too long. In these instances, high-performance settings provide the desired stability.

Good examples from practice

You can find good examples from practice for Amsterdam Airport Schiphol, KPN, Rabobank and the North Sea Canal Area Environment Agency below.

Amsterdam Airport Schiphol:

‘Power management has helped us achieve energy savings of 10-13%’

Royal Schiphol Group’s LEAP pilot yielded energy savings of 10 13% with astonishingly little effort. ‘It’s mainly a matter of checking your settings and making sure your servers are running when they really need to perform. The fear that this could affect performance is unjustified,’ Mark Spronk of Amsterdam Airport Schiphol explains.

Straight off, Royal Schiphol Group’s Commercial Director André van den Berg was enthusiastic when Marjolein Bot, the driving force behind the project, first mentioned LEAP and asked who would like to join the coalition of the willing at an Amsterdam Economic Board meeting in 2019. The LEAP project was assigned to Mark Spronk, a senior project manager at Schiphol’s IT department who is involved in the airport’s IT sustainability initiatives.

‘I genuinely share Van den Berg’s enthusiasm for the project,’ Spronk explains. ‘The energy we save on IT isn’t going to have a major impact in terms of reducing costs or making Schiphol more sustainable – IT simply doesn’t account for that much of our total energy consumption. However, we need to look at the bigger picture, and the fact that we’re all genuinely committed to sustainability is what matters. Schiphol is working to increase sustainability in many areas, and LEAP is an important part of that effort. Our pilot project also showed that you can achieve energy savings of 10-13% with very little effort. That’s a remarkable yield.’

Sustainability drive

As Spronk explains, Schiphol has set ambitious goals in terms of sustainability. ‘The airport is on track to be totally emission free and waste neutral by 2030, with the overall industry set to be carbon-neutral by 2050. Some examples: some of our terminals have thermal energy storage, and the A pier currently being built already has a high LEED rating (sustainability label, ed.). We’re also actively engaged in circular building and are currently one of the first international airports to be running a taxibot pilot. This tow truck taxies aircraft to the runway, considerably reducing the amount of time our aircraft have to keep their engines running. Schiphol also runs entirely on Dutch wind energy.’

With regard to LEAP, Schiphol has a diverse IT park, including local servers, DC servers and cloud solutions. The pilot project on power management settings – Schiphol has not gotten around to virtualisation yet – was run on a number of test servers, Spronk explains, ‘We obviously conducted measurements before and after the tests, and they showed significant energy savings of up to 13%. I should add that it all depends on the amount of server load and the relevant server’s specific function.’

Easy pickings

Striking the right balance between power management and optimal/essential performance is considered a stumbling point by some users. Does that also apply to Schiphol? Spronk says, 'As studies proved years ago, the fear of performance loss is unfounded. It does not exist in practice. Power management is nothing new – those settings have been on our devices for years. However, we found that they aren't always used to optimum effect in practice.'

The pilot has been very helpful in raising internal awareness about the benefits of energy-efficient power consumption. Spronk says, 'I also hope it will encourage other organisations – both within and outside the context of LEAP – to rethink their settings. These easy pickings yield high returns.'

The entire chain

As Spronk points out, LEAP also offers another key benefit: the entire IT chain is represented within the project. 'From hardware suppliers to knowledge institutions to end users – all parties are represented – that's how you learn from one other. For example, I found the presentation by KPN – which takes a broad view of sustainability – inspiring. LEAP is also yielding spin-offs, such as the ongoing immersion cooling project by participant Asperitas.'

Spronk is also impressed by the commitment of participating hardware suppliers: 'Dell, IBM, HPE, VMware – 80% of that market is now on board. As far as I'm concerned, they are already doing a lot to encourage energy efficiency among users.'

What next? Schiphol will be expanding the pilot in order to further improve its own power management and make changes where necessary. This reflects LEAP's commitment to promoting evidence-based best practices in the areas of power management and virtualisation. Spronk says, 'I would urge anyone who hasn't carried out their own pilot project yet to do so. It's a minor effort that yields great results.'

KPN:

'More efficient data centres yield significant energy savings'

Designing data centres in such a way that they harness the maximum amount of energy from networks and applications: this approach can yield enormous energy savings, resulting in greater sustainability. The Lower Energy Acceleration Program (LEAP) was recently launched in the Amsterdam region. LEAP is researching the precise impact of more efficient data centre design. One of the pilot projects was hosted by KPN's internal data centre. One of the key questions was: does energy conservation lead to slower servers?

As part of the pilot project (a component of the first LEAP phase), KPN employees assessed the short-term energy conservation potential from existing technology. They carried out various modifications to a server running less critical applications (a low-profile server). Did the measures achieve any energy savings? Did the changes affect server speed?

Activating eco mode

One of KPN's most significant changes involved activating the system's eco mode. As it turned out, this yielded an energy saving of 7%. The good news is that the KPN employees using the server did not even notice the changes. In other words, eco mode did not slow down the low-profile server's performance. KPN has been designing highly efficient servers for some time now. Most data centres are less energy-efficient. Pilot project participants thus expect the use of eco mode to have an even greater impact at other data centres.

Considerable energy savings

The KPN staff are now eager to see if they can achieve the same savings on a high-profile server. This is a server that is used by a large number of employees, and it remains to be seen whether they will be negatively impacted by the energy conservation measures. If the adjustments prove successful, they can then be implemented throughout the entire data centre. 'This would yield considerable energy savings, benefiting KPN, Amsterdam and the world,' as one KPN employee explained.

Next steps

The Netherlands Enterprise Agency expects to be able to publish the final report with further examples from the LEAP pilot in October 2020.

Would you like to know more?
Read the full interview.

Rabobank:

‘An eye-opening fact about LEAP? We're already very efficient’

Achieving power management and virtualisation without any negative impact on performance and availability? LEAP participant Rabobank is already pushing the limits of what is possible in this area, Paul Soethout and Wessel van Sandwijk of the bank’s Compute & Convergence division explain. ‘In a sense, we’ve already been doing LEAP for years.’

Senior system manager Wessel van Sandwijk acts as the technical conscience of the Compute & Convergence team; as team leader, Paul Soethout is the team’s organisational conscience. Rabobank management announced its intention to participate in LEAP at the end of 2019. Van Sandwijk and Soethout have since taken part in two meetings. The first served to define the objectives for LEAP; the results of the initial pilot projects were then presented during the second.

As efficiently as possible

The pilot projects are centred on power management – setting up servers as efficiently as possible without loss of performance. Rabobank did not use eco mode during the trial runs. Soethout says, ‘That would mean shutting down the server, which we wanted to avoid. We used Dynamic OS control mode. As the tests showed, we are already pushing the limits of what is possible in terms of power management. LEAP has been a real eye-opener for us in that sense.’
Van Sandwijk adds: ‘In a sense, we’ve already been doing LEAP for years. Although we can still tweak our settings a bit, we are already optimally efficient in terms of energy consumption.’

Dilemmas

However, customers do expect a certain level of performance, Van Sandwijk explains: ‘This inevitably requires a certain amount of energy. It’s all about finding the optimal balance between performance and energy efficiency. Performance is leading, so there’s only so much you can do in that sense. Suppose you could reduce your energy consumption by 40%, but that would make your performance 50% less effective. That could lead to situations where the customer has to wait much longer at the ATM, for example, which may not be a desirable outcome.’

This is just one example of the dilemmas we are facing. New systems tend to be a lot more energy-efficient than old ones. Does that necessarily mean you should replace all your old systems? As Soethout points out, we need to view energy efficiency in a broader context: ‘The idea of replacing systems sounds good on paper, but these operations are both expensive and resource-intensive in terms of energy and raw materials. That’s why we tend to take a more nuanced view.’

Room for virtualisation

Rabobank does not have much room for improvement in terms of settings. But does this also apply to virtualisation – optimising the balance between server capacity and energy consumption? How is Rabobank approaching this aspect?

As Van Sandwijk explains, there is still room for improvement. ‘You can run dozens of virtual servers on a single physical host. While we’re already applying that approach to a certain extent, we can still do better. For example, there’s no reason why the ABNAMRO and Rabobank web servers couldn’t run as virtual servers at a single physical data centre. These types of virtualisation efforts are becoming increasingly common and should

eventually lead to consolidation. As a result, you'll eventually only need a few data centres instead of the current 200 or so in the Amsterdam metropolitan region alone. That's obviously going to yield major energy savings.'

Security issue

However, Van Sandwijk and Soethout are also keen to provide some nuance here. They explain that there is a reason for the large number of data centres. 'From a security perspective, there is certainly something to be said for banks having their own physical data centres. We're confident this security issue will eventually be resolved, but it will require an effort by the hardware suppliers.'

The close involvement of hardware suppliers is one of the great upsides to LEAP. Soethout says, 'As users, we have a duty to make our energy consumption as green as possible. However, the suppliers will also need to make some improvements. For example, they'll have to further standardise their operations. They can build their systems to be more energy-efficient – the cooling systems used in all of Rabobank's modular computers still account for 40-50% of total energy costs right now.'

The role of suppliers

Suppliers could also provide more effective information on designing energy-efficient ICT systems. Soethout says, 'LEAP has revealed that some participants have not yet configured optimal energy settings. Better support from suppliers could help with this. LEAP is also helping to bring about closer alignment between suppliers and users.'

One final question: Would it be a good thing if other banks in the region also participated in LEAP? Soethout is sure it would. He adds, 'In fact, we should be taking an even broader view: we should be addressing issues like virtualisation and consolidation at a European level. That way, we could make a real difference.'

North Sea Canal Area Environment Agency:

‘LEAP can also benefit small-scale players like us’

The North Sea Canal Area Environment Agency (OD NZKG) only has three modestly sized servers at its office in Zaandam, so you might be forgiven for thinking that LEAP will not make much of a difference. ‘However, we reduced our energy consumption levels by 14% simply by adjusting the power settings. If you were to apply these savings to all other small-scale players, that would be pretty interesting.’

There are two good reasons for OD NZKG to participate in LEAP, the energy-conservation programme set up by the Amsterdam metropolitan region. The first is that saving energy is always good, even if it is only a little. The second is that it ties in with the agency’s work. OD NZKG is an implementing agency that serves provincial and municipal government bodies in the North Sea Canal Area. It is responsible for issuing permits and ensuring that all parties comply with their legal requirements in the area of the environment, soil quality and construction. The environmental agency provides information and advice about noise pollution, air quality, environmental safety, tunnels and energy conservation. ‘If we want to do our job right, we have to make sure our own house is in order first,’ Patrick Teunissen, climate and energy advisor at OD NZKG explains.

Active measures

Power management and virtualisation have been included in the statutory energy conservation measures for the North Sea Canal Area. Teunissen: ‘Right now, we mostly just provide information and advice about this. However, the time will come when businesses and citizens will be required to actively take measures. At that time, we will be enforcing these new rules,’ Teunissen explains.

We have not yet reached that stage. Teunissen believes that LEAP will be a source of inspiration for the region and will help make the transition to energy-efficient use of data using ICT. ‘I’ve been involved from day one and represent OD NZKG in the LEAP steering group. Within LEAP, we’re currently developing a road map to ensure that these energy conservation measures are effectively implemented in the coming years.’

A report will soon be published with the results of the power management experiments that were recently carried out by LEAP participants. ‘The participants ranged from very big to very small, painting an excellent picture of the performance and energy efficiency that we can achieve. For example, extensively virtualised parties can reduce energy consumption by 10% by implementing optimised power management,’ Teunissen explains.

What have you done at OD NZKG?

‘We use Software as a Service as much as possible,’ says technical advisor Jan de Wit. ‘Our servers in Zaandam, which are mostly used for our virtual home-working environment, were set to High Performance mode. Over the course of 12 days, we took measurements using dynamic settings. In the end, we concluded that Balanced was the most suitable setting, because it reduces energy consumption per working day by 14% without any loss of performance. I hadn’t expected that big of a reduction. We’re only a minor player, of course, but if such major savings could be applied to all other small-scale parties in the region, that would be pretty interesting.’

‘We also experimented with the Power Saving mode, but this didn’t result in any savings. The end result is that the power settings are now set to Balanced mode as standard.’

‘This information is also very interesting to DUVAK, our ICT service provider,’ adds Teunissen. ‘If DUVAK can advise its clients on how to save energy without performance loss, that’s an added bonus. DUVAK is very interested in hearing about the results of LEAP.’

So what's the conclusion?

'A report of the results of the first phase of LEAP will be published soon,' says Teunissen. 'This will also change our habits as a user. Based on this information, when awarding ICT contracts in the future, we can require our ICT suppliers to implement greater energy conservation measures.'

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