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## Saving Power with VMware vSphere ESX – Dynamic Voltage and Frequency Scaling (DVFS).

October 27th, 2009 Kiwi Si



(<http://www.techhead.co.uk/category/vmware>)



With green computing, the introduction of the concept of a carbon footprint and the increasing cost of power businesses and individuals are more aware than ever of the virtues of running IT equipment as economically as possible, without jeopardising stability or performance.

To assist in making your virtualized environment more energy efficient VMware released a nice new feature in ESX/ESXi 4.0 called Dynamic Voltage and Frequency Scaling (DVFS) which contributes towards the reduction of your server infrastructure's power consumption.

### So what is DVFS?



Dynamic Voltage and Frequency Scaling allows an ESX/ESXi host to dynamically switch its CPU frequency dependent on its load requirement. It does this by continuously monitoring the CPU utilisation with the DVFS algorithm determining any necessary adjusts to the CPU's frequency with the goal being to run the CPU at a lower frequency so that it consumes less power. It uses processor performance states (P-states) presented to the VMkernel through an ACPI interface to achieve this.

For example: If your 2GHz CPU is sitting at 30% utilization then DVFS will reduce the frequency of the CPU so it will operate nearer to its 600MHz frequency requirement including enough headroom to accommodate a sudden increase in CPU requirement.

For an ESX/ESXi host to take advantage of DVFS its CPU's will need to support the Enhanced **Intel** SpeedStep or Enhanced **AMD** PowerNow! CPU power management technologies. This power saving feature must be enabled in the hosts BIOS before it will show in the 'Configuration' tab of ESX/ESXi.

**Below:** With Enhanced Intel SpeedStep enabled in my HP Proliant ML110's BIOS it shows up in ESX's CPU configuration:

Performance Configuration Tasks & Events Alarms Permissions Maps Storage Views		
<b>Processors</b>		
<b>General</b>		
Model	Intel(R) Xeon(R) CPU	3065 @ 2.33GHz
Processor Speed	2.3 GHz	
Processor Sockets	1	
Processor Cores per Socket	2	
Logical Processors	2	
Hyperthreading	N/A	
Power Management Technology	Enhanced Intel SpeedStep(R)	
Power Management Policy	static	
<b>System</b>		
Manufacturer	HP	
Model	ProLiant ML110 G5	
BIOS Version	015	
Release Date	03/07/2008 00:00:00	
Asset Tag	No Asset Tag	

**Below:** My HP Proliant ML115 G5 with 'Enhanced AMD PowerNow! enabled:

Resource Allocation Performance Configuration Users & Groups Events Permissions		
<b>Processors</b>		
<b>General</b>		
Model	Quad-Core AMD Opteron(tm) Processor 1352	
Processor Speed	2.1 GHz	
Processor Sockets	1	
Processor Cores per Socket	4	
Logical Processors	4	

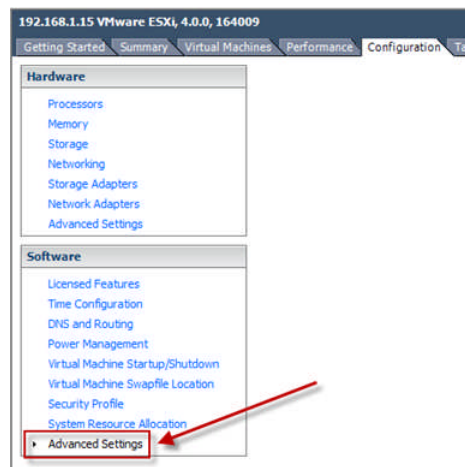
hypervthreading	N/A
Power Management Technology	Enhanced AMD PowerNow!(TM)
Power Management Policy	Dynamic
<b>System</b>	
Manufacturer	HP
Model	ProLiant ML115 G5
BIOS Version	018
Release Date	26/05/2008 00:00:00
Asset Tag	unknown

## How do I configure DVFS?

As mentioned above to be able to use DVFS your ESX host needs the following:

- A CPU(s) with Enhanced Intel SpeedStep or Enhanced AMD PowerNow! CPU power management technologies.
- For Enhanced Intel SpeedStep or Enhanced AMD PowerNow! to be enabled in the BIOS.

Once your host meets these criteria you then need to change one of ESX's 'Advanced Settings' (see below) from 'static' (the default) to 'dynamic'.



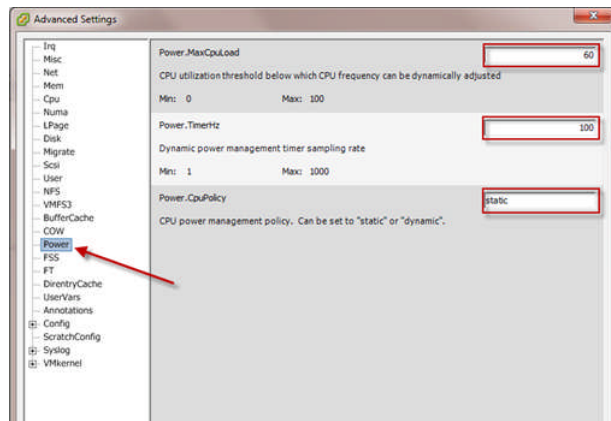
From the [vSphere Resource Management Guide](http://www.vmware.com/pdf/vsphere4/r40/vsp_40_resource_mgmt.pdf) ([http://www.vmware.com/pdf/vsphere4/r40/vsp\\_40\\_resource\\_mgmt.pdf](http://www.vmware.com/pdf/vsphere4/r40/vsp_40_resource_mgmt.pdf)):

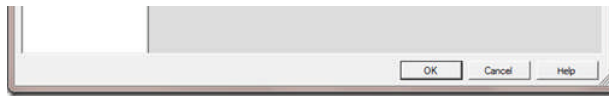
To set the CPU power management policy, use the advanced host attribute **Power.CpuPolicy** (see screenshot below). This attribute setting is saved in the host configuration and can be used again at boot time, but it can be changed at any time and does not require a server reboot. You can set this attribute to the following values.

**static** – The default. The VMkernel can detect power management features available on the host but does not actively use them unless requested by the BIOS for power capping or thermal events.

**dynamic** – The VMkernel optimizes each CPU's frequency to match demand in order to improve power efficiency but not affect performance. When CPU demand increases, this policy setting ensures that CPU frequencies also increase.

You may also want to tweak either of the other two DVFS configuration parameters – though in most circumstances these should be left at the default values.

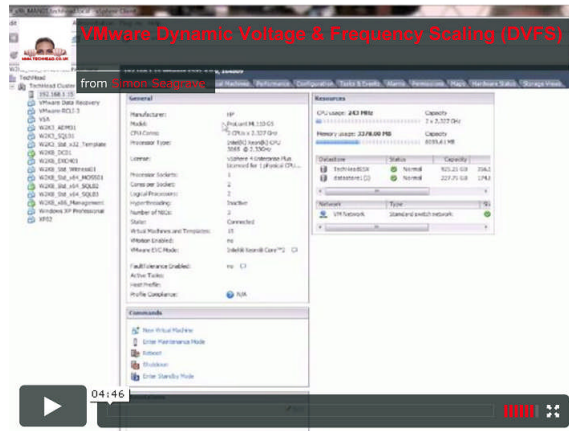




(<http://www.techhead.co.uk/wp-content/uploads/2009/10/image19.png>)

### So how much power does it save?

In this video I demonstrate how to set your ESX host to use DVFS and give a real world example of the power savings on my HP Proliant ML110 G5 server.



### For more information see:

[vSphere Resource Management Guide \(http://www.vmware.com/pdf/vsphere4/r40/vsp\\_40\\_resource\\_mgmt.pdf\)](http://www.vmware.com/pdf/vsphere4/r40/vsp_40_resource_mgmt.pdf) (Page 22)

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28 October, 2009 at 9:41 am (<http://www.techhead.co.uk/saving-power-with-vmware-vsphere-esx-dynamic-voltage-and-frequency-scaling-dvfs#comment-9680>)

Have you compared the VM performance after enabling this option? On hosted products the difference is sometimes very noticable when this is enabled.

Lars

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2. [Cody Bunch \(http://professionalvmware.com\)](http://professionalvmware.com) says:  
30 October, 2009 at 1:29 pm (<http://www.techhead.co.uk/saving-power-with-vmware-vsphere-esx-dynamic-voltage-and-frequency-scaling-dvfs#comment-9700>)

That's pretty slick. I'd be interested in any adverse effects you notice after enabling it. What does it do, if anything, to performance?

-Cody

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3. [Tame Electrical and Heating Costs with CPU Power Management » boche.net – VMware Virtualization Evangelist](#) (<http://www.boche.net/blog/index.php/2009/11/11/tame-electrical-and-heating-costs-with-cpu-power-management/>) says:  
18 November, 2009 at 1:48 pm (<http://www.techhead.co.uk/saving-power-with-vmware-vsphere-esx-dynamic-voltage-and-frequency-scaling-dvfs#comment-9758>)

[...] I was just made aware that Simon Seagrave wrote an earlier article on CPU power management here. Sorry Simon, I was unaware of your article and I did not intentionally copy your topic. Your [...]

4. [Power Management in ESXi 4.1 – Facts and Figures](#) (<http://blog.peacon.co.uk/power-management-in-esxi-4-1-facts-and-figures/>) says:  
27 July, 2010 at 12:39 pm (<http://www.techhead.co.uk/saving-power-with-vmware-vsphere-esx-dynamic-voltage-and-frequency-scaling-dvfs#comment-11205>)

[...] The vSphere 4 release included a fair bit of marketing fluff about power management, which when it came down to the fact was some fairly basic CPU frequency scaling, which had to be enabled by changing the advanced setting 'power.cpuPolicy' to 'dynamic'. [...]

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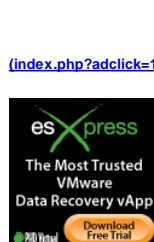
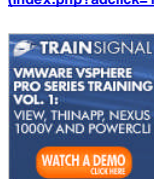
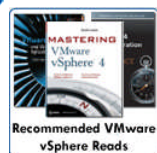
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## • ABOUT TECHHEAD



My name is Simon Seagrave and I am a London (UK) based Senior Technology Consultant and vSpecialist working for EMC.

I love my work and spend most of my time working with and exploring Virtualisation Technologies in particular VMware products. In my home IT lab I use VMware vSphere, HP Proliants and various storage products along with many of Microsoft's back office products.

This blog was created for my own use and as a reference of useful articles, etc that I came across on my travels. Though as time has progressed it is good to see that other people are accessing it also. I hope you find it useful. :)

The Disclaimer Bit: Although I work for EMC, my thoughts and views expressed in this blog are purely my own and are not those of EMC. I am not a blogger for EMC and write about topics and products which interest me, and hopefully you too.

Twitter: Kiwi\_Si

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Email: [simon at techhead dot co dot uk](mailto:simon@techhead.co.uk) (<mailto:simon@techhead.co.uk>)

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- ☐ No
- ☐ No - but plan to do so within the next month
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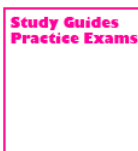
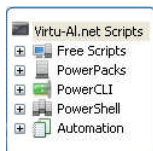
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- [VMworld® 2010, the Leading Virtualization Event of the Year, Comes to San Francisco and Copenhagen - This Year Educating Attendees on the Virtual Road to Cloud Computing](http://feeds.vmware.com/l/?s=100003s2bbd2q8u0ak9&r=wordpress&he=68747470253341253246253246777772e766d776172652e636f6d253246636f6d70616e792532466e65777325324672656c6561736573253246766d776f726c6431307468656d652e68746d6c&i=727373696e3a687474703a2f2f777772e766d776172652e636f6d2f636f6d70616e792f6e6577732f72656c65617365732f766d776f726c6431307468656d652e68746d6c) (<http://feeds.vmware.com/l/?s=100003s2bbd2q8u0ak9&r=wordpress&he=68747470253341253246253246777772e766d776172652e636f6d253246636f6d70616e792532466e65777325324672656c6561736573253246766d776f726c6431307468656d652e68746d6c&i=727373696e3a687474703a2f2f777772e766d776172652e636f6d2f636f6d70616e792f6e6577732f72656c65617365732f766d776f726c6431307468656d652e68746d6c>) 27 July, 2010
- [VMware Launches New Volume Purchasing Program](http://feeds.vmware.com/l/?s=100003s2bbd2q8u0ak9&r=wordpress&he=68747470253341253246253246777772e766d776172652e636f6d253246636f6d70616e792532466e65777325324672656c65617365732532467670702d3037323731302e68746d6c&i=727373696e3a687474703a2f2f777772e766d776172652e636f6d2f636f6d70616e792f6e6577732f72656c65617365732f766d776f726c6431307468656d652e68746d6c) (<http://feeds.vmware.com/l/?s=100003s2bbd2q8u0ak9&r=wordpress&he=68747470253341253246253246777772e766d776172652e636f6d253246636f6d70616e792532466e65777325324672656c65617365732532467670702d3037323731302e68746d6c&i=727373696e3a687474703a2f2f777772e766d776172652e636f6d2f636f6d70616e792f6e6577732f72656c65617365732f766d776f726c6431307468656d652e68746d6c>) 27 July, 2010
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- [VMware Advances Foundation for Cloud Computing With VMware vSphere 4.1 and Expanded Virtualization Management Portfolio](http://feeds.vmware.com/l/?s=100003s2bbd2q8u0ak9&r=wordpress&he=68747470253341253246253246777772e766d776172652e636f6d253246636f6d70616e792532466e65777325324672656c6561736573253246767370686572652d342d312e68746d6c&i=727373696e3a687474703a2f2f777772e766d776172652e636f6d2f636f6d70616e792f6e6577732f72656c65617365732f767370686572652d342d312e68746d6c) (<http://feeds.vmware.com/l/?s=100003s2bbd2q8u0ak9&r=wordpress&he=68747470253341253246253246777772e766d776172652e636f6d253246636f6d70616e792532466e65777325324672656c6561736573253246767370686572652d342d312e68746d6c&i=727373696e3a687474703a2f2f777772e766d776172652e636f6d2f636f6d70616e792f6e6577732f72656c65617365732f767370686572652d342d312e68746d6c>) 14 July, 2010
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- [Blade Watch](http://www.bladewatch.com/) (<http://www.bladewatch.com/>)
- [Kevin Houston's Blade Server Blog – Kevin Houston](http://kevinbladequy.wordpress.com/) (<http://kevinbladequy.wordpress.com/>)
- [View Yonder – Steve Chambers](http://viewyonder.com/) (<http://viewyonder.com/>)

## • #Storage

- [Around the Storage Block Blog – Calvin Zito](http://www.communities.hp.com/online/blogs/datastorage/Default.aspx) (<http://www.communities.hp.com/online/blogs/datastorage/Default.aspx>)
- [Ruptured Monkey – Nigel Poulton](http://blogs.rupturedmonkey.com/) (<http://blogs.rupturedmonkey.com/>)
- [Stephen Foskett, Pack Rat – Steve Foskett](http://blog.foskett.net/) (<http://blog.foskett.net/>)
- [Storage Monkeys – Greg Knieriemien](http://www.storagemonkeys.com/) (<http://www.storagemonkeys.com/>)
- [Storage Nerve – Devang Panchigar](http://storagenerve.com/) (<http://storagenerve.com/>)
- [The Storage Architect – Chris Evans](http://thestoragearchitect.com/) (<http://thestoragearchitect.com/>)
- [Virtual Geek – Chad Sakac](http://virtualgeek.typepad.com/) (<http://virtualgeek.typepad.com/>)

## • #Virtualisation - VMware

- [Boche.Net – Jason Boche](http://www.boche.net/blog/) (<http://www.boche.net/blog/>)
- [Gabs Virtual World – Gabriele van Zanten](http://www.gabesvirtualworld.com/) (<http://www.gabesvirtualworld.com/>)
- [Hypervisor – Hany Michael](http://www.hypervisor.com/) (<http://www.hypervisor.com/>)
- [Ken's Virtual Reality – Ken Cline](http://kensvirtualreality.wordpress.com/) (<http://kensvirtualreality.wordpress.com/>)
- [LucD Notes – Luc Dekens](http://lucd.info/) (<http://lucd.info/>)
- [Mike D's Blog – Mike DiPetrillo](http://www.mikedipetrillo.com/) (<http://www.mikedipetrillo.com/>)
- [Musings of Rodos – Rodney Haywood](http://rodos.haywood.org/) (<http://rodos.haywood.org/>)
- [NTPRO.NL – Eric Sloof](http://www.ntpro.nl/blog/) (<http://www.ntpro.nl/blog/>)
- [PlanetVM – Tom Howarth](http://planetvm.net/blog/) (<http://planetvm.net/blog/>)
- [RTFM Education – Mike Laverick](http://www.rtfm-ed.co.uk/) (<http://www.rtfm-ed.co.uk/>)

- [Scott Lowe \(http://blog.scottlowe.org/\)](http://blog.scottlowe.org/)
- [Technodrone – Maish Saidel-Keesing \(http://technodrone.blogspot.com/\)](http://technodrone.blogspot.com/)
- [The SLOG – Simon Long \(http://www.simonlong.co.uk/blog/\)](http://www.simonlong.co.uk/blog/)
- [The Virtual Traveller – Doug Hazelman \(http://doughazelman.com/blog/\)](http://doughazelman.com/blog/)
- [vCritical – Eric Gray \(http://www.vcritical.com/\)](http://www.vcritical.com/)
- [VI Toolkit – Wil van Antwerpen \(http://www.vi-toolkit.com/wiki/index.php/Main\\_Page\)](http://www.vi-toolkit.com/wiki/index.php/Main_Page)
- [vinf.net – Simon Gallagher \(http://vinf.net/\)](http://vinf.net/)
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- [Virtualistic.nl \(http://www.virtualistic.nl/\)](http://www.virtualistic.nl/)
- [Virtualize Planet – Ricky El-Qasem \(http://blog.virtualizeplanet.com/\)](http://blog.virtualizeplanet.com/)
- [VM/ETC – Rich Bramley \(http://vmetc.com/\)](http://vmetc.com/)
- [VMGuy – Dave Lawrence \(http://vmguy.com/wordpress/\)](http://vmguy.com/wordpress/)
- [VMWare ESX Compatibility Guide \(http://www.vmware.com/resources/guides.html\)](http://www.vmware.com/resources/guides.html)
- [VMware ESX Partition Configuration \(http://www.vmware.com/pdf/esx3\\_partition\\_align.pdf\)](http://www.vmware.com/pdf/esx3_partition_align.pdf)
- [VMware Lover – Daniel Eason \(http://vmlover.blogspot.com/\)](http://vmlover.blogspot.com/)
- [VMware Tips – Rick Scherer \(http://vmwaretips.com/wp/\)](http://vmwaretips.com/wp/)
- [VMWare Virtualised Infrastructure Webcast from HP \(http://library.theserverside.com/detail/RES/1182529447\\_485.html\)](http://library.theserverside.com/detail/RES/1182529447_485.html)
- [vSphere Land – Eric Siebert \(http://vsphere-land.com\)](http://vsphere-land.com/)
- [Yellow Bricks – Duncan Epping \(http://www.yellow-bricks.com/\)](http://www.yellow-bricks.com/)

## • Apple Mac

- [Open Source Mac \(http://www.opensourcemac.org/\)](http://www.opensourcemac.org/)

## • Blogging

- [Windows Live Writer \(http://windowslivewriter.spaces.live.com/blog/cnsID85741BB5E0BE8AA1174.entry\)](http://windowslivewriter.spaces.live.com/blog/cnsID85741BB5E0BE8AA1174.entry)

## • Cloud Computing

- [Cloud Gathering \(http://opencloud.ning.com/\)](http://opencloud.ning.com/)

## • Hewlett Packard (HP) Related Links

- [HP Active Answers \(http://www.hp.com/go/activeanswers\)](http://www.hp.com/go/activeanswers)
- [HP Certification Portal \(http://www.hp.com/go/certification\)](http://www.hp.com/go/certification)
- [HP Enterprise Configurator \(http://h30099.www3.hp.com/configurator/\)](http://h30099.www3.hp.com/configurator/)
- [HP IT Resource Centre \(http://www.itrc.hp.com\)](http://www.itrc.hp.com)
- [HP Part Surfer \(http://partsurfer.hp.com\)](http://partsurfer.hp.com)
- [HP Product Bulletin \(http://www.hp.com/go/productbulletin\)](http://www.hp.com/go/productbulletin)
- [HP Re-Certification Schedule \(http://www.hp.com/certification/continuous\\_learning.html#selecttechfamily\)](http://www.hp.com/certification/continuous_learning.html#selecttechfamily)
- [HP Scripting Toolkit \(http://h18000.www1.hp.com/products/servers/management/toolkit/download.html\)](http://h18000.www1.hp.com/products/servers/management/toolkit/download.html)
- [HP Server Blogs \(http://www.hp.com/hpinfo/blogs/index.html\)](http://www.hp.com/hpinfo/blogs/index.html)
- [HP Smart Portal \(http://www.hp.com/eur/smartportal\)](http://www.hp.com/eur/smartportal)
- [HP Software Demos \(http://h20229.www2.hp.com/demos\)](http://h20229.www2.hp.com/demos)

## • I.T Utilities & Tools

- [ExamDiff \(http://www.prestosoft.com/edp\\_examdiff.asp\)](http://www.prestosoft.com/edp_examdiff.asp)
- [ForensIT \(http://www.forensit.com/downloads.html\)](http://www.forensit.com/downloads.html)
- [Hyena – Windows All in One Sys Admin Tool. \(http://www.systemtools.com/hyena/\)](http://www.systemtools.com/hyena/)
- [Info Box \(http://www.theinfobox.com/index.php/Portable\\_USB\\_Apps\)](http://www.theinfobox.com/index.php/Portable_USB_Apps)
- [Notepad ++ \(http://notepad-plus.sourceforge.net/uk/site.htm\)](http://notepad-plus.sourceforge.net/uk/site.htm)
- [Portable Freeware \(http://www.portablefreeware.com/\)](http://www.portablefreeware.com/)
- [Post Cast Server \(http://www.postcastserver.com\)](http://www.postcastserver.com)
- [True Crypt \(http://www.truecrypt.org/\)](http://www.truecrypt.org/)
- [Wildpackets IP Subnet Calculator \(http://www.wildpackets.com/products/free\\_utilities/ipsubnetcalc/overview\)](http://www.wildpackets.com/products/free_utilities/ipsubnetcalc/overview)

## • IT Blogs (General)

- [Mark Wilson Blog \(Microsoft Related\) \(http://www.markwilson.co.uk/blog/\)](http://www.markwilson.co.uk/blog/)
- [View Yonder – Steve Chambers \(http://viewyonder.com/\)](http://viewyonder.com/)

## • IT Communities & Information Sites

- [Expiring Domain Names \(http://www.deleting.co.uk\)](http://www.deleting.co.uk)
- [Friends in Tech \(http://www.friendsintech.com\)](http://www.friendsintech.com)
- [iis.net \(http://www.iis.net\)](http://www.iis.net)

## • IT Contracting

- [Contractor UK \(http://www.contractoruk.com\)](http://www.contractoruk.com)
- [HM Revenue & Customs Flat Rate Scheme for Small Businesses \(http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?\\_nfpb=true&\\_pageLabel=pageImport\\_ShowContent&propertyType=document&columns=1&id=HMCE\\_CL\\_000345\)](http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageImport_ShowContent&propertyType=document&columns=1&id=HMCE_CL_000345)
- [Job Jock \(http://www.dreamturbine.com\)](http://www.dreamturbine.com)

## • Microsoft- Other

- [Microsoft IMM Team Blog \(http://blogs.msdn.com/imm/\)](http://blogs.msdn.com/imm/)

## • Networking

- [Das Blinken Lichten – Jon Langemak \(http://www.dasblinkenlichten.com/\)](http://www.dasblinkenlichten.com/)

## • Online Utils & Tools

- [DNS Stuff \(http://www.dnsstuff.com\)](http://www.dnsstuff.com)
- [L8NC \(http://www.l8nc.com/\)](http://www.l8nc.com/)
- [Microsoft Solution Accelerators \(http://technet.microsoft.com/en-us/solutionaccelerators/default.aspx\)](http://technet.microsoft.com/en-us/solutionaccelerators/default.aspx)
- [StatBrain \(http://www.statbrain.com\)](http://www.statbrain.com)
- [Ted's Web Tools \(http://www.mob.net/~ted/tools/index.html\)](http://www.mob.net/~ted/tools/index.html)
- [Who Is \(http://whois.domaintools.com/\)](http://whois.domaintools.com/)

## • SAN

- [Clariion Blog \(http://clariionblogs.blogspot.com/\)](http://clariionblogs.blogspot.com/)
- [HP StorageWorks \(http://h18006.www1.hp.com/storage/\)](http://h18006.www1.hp.com/storage/)
- [HP StorageWorks Networking \(http://h18006.www1.hp.com/storage/networking/index.html\)](http://h18006.www1.hp.com/storage/networking/index.html)

## • Security

- [Windows Security \(http://www.windowsecurity.com\)](http://www.windowsecurity.com)

## • Server Builds

- [Windows Shell Setup Reference \(http://technet2.microsoft.com/windowsvista/de/library/a3e69559-0d32-49e8-a365-c70558730df41031.mspx?mfr=true\)](http://technet2.microsoft.com/windowsvista/de/library/a3e69559-0d32-49e8-a365-c70558730df41031.mspx?mfr=true)

## • SharePoint

- [Joe Oleson's – Sharepoint Land \(http://blogs.msdn.com/joelo/default.aspx\)](http://blogs.msdn.com/joelo/default.aspx)
- [Microsoft MSDN SharePoint Forum \(http://forums.microsoft.com/MSDN/default.aspx?ForumGroupID=328&SiteID=1\)](http://forums.microsoft.com/MSDN/default.aspx?ForumGroupID=328&SiteID=1)
- [SharePoint Forum \(http://www.sharepointforum.com\)](http://www.sharepointforum.com)
- [SharePoint University \(http://www.sharepointu.com/\)](http://www.sharepointu.com/)

## • Sharepoint

- [SharePoint Buzz \(http://www.sharepointbuzz.com\)](http://www.sharepointbuzz.com)

## • Technical References

- [Network Dictionary \(http://www.networkdictionary.com\)](http://www.networkdictionary.com)

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- [Backups & Replication \(http://www.techhead.co.uk/category/vmware/backups-replication\)](http://www.techhead.co.uk/category/vmware/backups-replication)
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