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Tuesday, 01 September 2015

Peaking Photoshop Performance

Not enough RAM and a conventional hard drive will cause performance to slow down just a tad.

Written by **Ctein**

[**Author's note**: *I'm hard at work on the third edition of my book* Digital Restoration from Start to Finish. *It'll be out sometime early next year (I think). Meanwhile, here's an excerpt for your enjoyment and edification.*]

Whether you're using Photoshop or some other image processing program, maximizing its performance is especially important when doing photographic restoration. It's easy to generate huge files, bigger than what you're likely to be working with from a digital camera. For example, an 8x10 photograph scanned at 600 PPI in 16-bit color yields a 30 megapixel, 180 MB file. I'll be talking about Photoshop, specifically, but if the image processing program you're running can make use of a scratch disk when it runs out of RAM, the same general advice will apply.

Here's the non-technical version: Stuff your computer with as much RAM as it will support. RAM is cheap. Less than 8 GB will badly cramp your style. Working on a large and complex restoration, double that is barely adequate. My 27" i7 Retina iMac has 32 GB of RAM, 24 GB of which are allocated to Photoshop. You want to leave enough RAM free for other machine functions so that they don't choke—75% is a safe amount to give Photoshop. I can still run out of RAM in Photoshop on occasion...but it's a lot less common now than it was on my old system, which only had half as much memory.

Next, after maximizing your RAM, get an internal SSD (solid state drive) and use it for your operating system, applications including Photoshop, and the scratch disk. You should also put the photograph you're working on there. That doesn't require a very large SSD. A 256 GB SSD will handle this with plenty of room to spare. You can put all your data files and photographs that you're not working on on a different drive. Of course, there's nothing wrong with getting a big one and putting everything on it, including all your data files, but they're a lot more pricey.

A hybrid or "Fusion" drive doesn't really cut it for photo restoration. They marry a small solid-state drive to a conventional hard drive. That speeds up activities that demand accessing only a few gigabytes of data, like launching and relaunching applications, working with text and spreadsheets, and so on. The thing is, the scratch files that your image processing program will generate when it runs out of RAM are huge. They'll swamp the solid-state part of the hybrid drive, and then it performs no better than a conventional drive. Don't get me wrong; they're a distinct performance improvement over a traditional hard drive—but nowhere near what you'll see with a pure SSD.

Practical comparisons

Now I shall get geekily specific. Those of you who don't care, you can skip to the end. You won't miss much.

To convey to you a sense of just how much difference sufficient RAM and an SSD can make, I ran a set of benchmark tests using Lloyd Chambers Photoshop benchmarking actions. They're designed to stress the heck out of Photoshop. For these tests, I used the medium scale benchmark, diglloydMedium, because the small one simply ran too fast on my new machine to do accurate timing, and it didn't push huge amounts of data to the scratch disk.

I first ran the benchmark with Photoshop allocated its full 24 GB of RAM. That's enough RAM that Photoshop didn't have to use the scratch drive. It ran diglloydMedium in a little over 11 seconds with a maximum CPU usage of over three cores (300+%), and it ate up about 15 GB of RAM.

Good enough. Then, what happens when Photoshop runs out of RAM, as it will on an under-equipped computer? I cut the Photoshop allocation back to 4 GB of RAM and ran the same benchmark with the iMac's internal SSD as the scratch drive. Even though data transfer to the scratch disk peaked out at over 900 MB/sec, the time to execute the benchmark almost tripled, to 30 seconds, and CPU usage barely exceeded 100%.

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Next I took the SSD out of the picture. I changed the Photoshop scratch disk to a fast external conventional hard drive. This, by the way, is the way you should be running if you don't have an internal SSD as your system drive. If your system drive is a regular hard drive, putting the scratch files there only sets you up for what's known as “drive thrashing.” The disk head has to bounce all over the place to keep up with the competing demands from the OS, the running programs, and the scratch space, and that slows things down horribly. Not a problem with an SSD.

With 4 GB of RAM and a conventional hard drive disk, performance just cratered. The runtime was two minutes with a peak data rate of 150 MB/sec to the drive. CPU usage barely got to 30%.

In summary, running with insufficient RAM and a conventional hard drive slowed the benchmark by a factor of ten!

'Nough said?

Ctein

Photo-writer, sci-fi novelist, photographer, and physicist Ctein is TOP's Technical Editor.

(To see all the comments, click on the "Comments" link below.)

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Posted on Tuesday, 01 September 2015 at 07:45 AM in Computers, Ctein, Digital Techniques, Software | Permalink

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Comments

I tried to convince someone last year that they didn't need a new computer, just more RAM and a solid state SSD scratch disk.

In the end they got a new computer - overclocked quad core i7, 8GB RAM, 4GB graphics card, a 1TB hybrid HDD and 3 case fans!

It's good for World of Warcraft, but my laptop is faster for Photoshop (SSD, 16GB RAM, 2 core mobile i5).

Posted by: Steve Jacob | Tuesday, 01 September 2015 at 08:24 AM

"'Nough said?", indeed. About a year ago I replaced the system/application drive of my RAM-crammed Mac Pro with a generously sized SSD. The increase in performance and decrease in start-up time was breathtaking. It was also amazing how much quieter and cooler the system became. I hadn't realized just how much low-level noise that drive had really made. Plus the system fans now seem to run at much lower speeds most of the time.

It was money well spent, at least for me. 'Nough said!

Posted by: Ken Tanaka | Tuesday, 01 September 2015 at 08:49 AM

Ctein:
Interesting as last month I had to take my computer in for "upgrading."
When I mentioned perhaps that I needed a new computer.
"No you don't. Just get a Solid State Drive."
Well, duh!
My two pesos.

Posted by: Hugh Smith | Tuesday, 01 September 2015 at 12:24 PM

Is there a test like that for Windows?

Posted by: marcin wuu | Tuesday, 01 September 2015 at 12:27 PM

Don't forget a high-ish Nvidia GPU with 4gb of vRAM (a midrange gaming GPU is fine, as long as it's post-2013). A post Ivy-Bridge CPU wouldn't hurt.

Posted by: Doug Nelson | Tuesday, 01 September 2015 at 12:32 PM

Good advice! Timeless, really. Max out the RAM and the buy the fastest HD you can applied in 1995 just as well as today.

For Lightroom I think a quad core processor is very helpful as well. Lightroom does not really "save" edits the way Photoshop does. Each time you edit a file, Lightroom has to start with your original file and apply all corrections that have been done in order to show you the image on the screen. That is a lot of math, which takes a lot of processor power to do quickly.

Note that this only applies in Lightroom's Edit mode. In other modes Lightroom does have up to date preview images ready for viewing, although these images may not have as high quality or resolution as what you see in edit mode.

Posted by: Bruce Mc | Tuesday, 01 September 2015 at 01:34 PM

SSD's are magic. I put one in my old Dell laptop, and it became a new machine.

Posted by: Mike R | Tuesday, 01 September 2015 at 03:07 PM

I have a Mac Pro with a 1TB SSD and have my system, applications and Photoshop scratch disk on it. I keep my photo files on a 6TB external hard drive connected via Thunderbolt 1. Is it worth moving the photo files on which I am currently working to the SSD and then back to the hard drive when I'm done with them?

[***Ctein*** *replies: Eric, I dunno. Why don't you run the experiment and report back to us?*

Posted by: Eric Brody | Tuesday, 01 September 2015 at 03:17 PM

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Does Lightroom or photoshop make use of multiple cores and/or hyperthreading? There isn't much of a clock speed difference between a lot of i5 and i7 processors but if photoshop can use hyperthreading then it may be worth it. Also curious to compare a current high end 13" MBP to the entry 15" MBP. Is a higher clock speed or extra cores more important?

[***Ctein*** *replies: Isaac, Photoshop definitely uses multiple cores--as I reported, CPU usage was over 300% (3+ cores) in the 24GB-RAM test. I don't know what effect hyperthreading has. More cores are more important than more clock speed. The low-end 15" MBP, with four cores, will significantly outperform the high-end two-core 13" MBP.*

Posted by: Isaac | Tuesday, 01 September 2015 at 03:38 PM

I have had performance problems since upgrading a A$4,000 mid-2011 iMac from Lion to Yosemite. I was forced into this to move to Lightroom 5 (in the hope of gaining custom book layout capability, which did not eventuate).

As soon as I upgraded, I ran into an Apple driver issue that Adobe's engineers are still awaiting a correction for. Many others have reported the same issue, starting in beta releases and remaining to date. The support thread is here http://feedback.photoshop.com/photoshop_family/topics/all_ado

Scroll to the end for the sorry state of the art from Adobe: "Chris Cox (Sr. Computer Scientist), Apple is still working on many issues we have reported in MacOS 10.10."

Although circa 2011, my machine is an iMac 3.4GHz with SSD and 16GB and it was very fast on Lion. As soon as the upgrade to Yosemite completed, most operations in Photoshop slowed to a crawl. A simple operation like Undo on a 16MP file used to be instantaneous on Lion. It now takes close to a second. Lightroom is similarly affected by the bug. With the help of Adobe support I have tried every possible tuning and diagnostic approach, but remain checkmated by Apple's bug.

[***Ctein*** *replies: Leigh, sorry I can't help you. I haven't seen these problems on either our old (2009) 27" iMac that was updated to Yosemite or my new retina iMac. You're not the only person to report odd slowdowns with Yosemite, but I have not encountered them.*]

Posted by: Leigh Perry | Tuesday, 01 September 2015 at 04:21 PM

Ctein, I didn't expect resolution from you, unless you are able to do some driver debugging :-) Mine was more a cautionary tale.

I moved from longtime Photoshop usage on a slowish Windows XP box to OS X to escape some annoying Photoshop behaviours and found that my new machine was much faster but with the same annoying behaviours. Oh well, at least it was faster. Then came the Yosemite upgrade which turned my still-newish fast expensive machine into merely an expensive machine. One that runs Photoshop slower than my original Windows box. The other attraction of OS X for an longstanding Windows user was the dissatisfaction that I liked each new version of Windows less than the previous. Oh, the irony.

Posted by: Leigh Perry | Tuesday, 01 September 2015 at 05:02 PM

I will happily echo the chorus of us who have replaced a spinning platter in an older machine with an SSD.

It's incredible. Truly breathtaking is the performance increase.

How good? I already bought my main machine's replacement, but as a last hurrah got an SSD for the old one - and after the upgrade... the old one is still my main machine, and the new one is my spare. I haven't yet seen the need to place the new computer in it's intended spot.

Posted by: Jim in Denver | Tuesday, 01 September 2015 at 05:31 PM

Just wanted to add that if you use Capture One for raw processing, you can get a solid performance boost out of using a good graphics card and enabling OpenCL as described here:

http://blog.phaseone.com/processing-speedup-using-multiple-gpus-capture-one-pro-8/

Posted by: Amin Sabet | Tuesday, 01 September 2015 at 05:34 PM

Standard SSD's are now yesterday news. They typically get about 5 to 600 MBS. Which is of course a lot more than a fast hard drive at 150 or so MBS. I've been using them for the last four years for everything except backup. Including a dedicated 3 SSD drive RAID 0 array which get almost 1,000 MBS.

But, I recently upgraded to a new super computer and while quite expensive the new intel PCIeFlash drive is simply amazing. It's run at about 2,000 MBS write and 3,000 MBS read. With each new megapixel camera, Nikon D800, now Canon 5 DS I've needed to upgrade my computers to keep the cobwebs out of the room. By the time I stitch togethor a 10-12 image set and add a couple or more adjustments layers I'm typically working on a image then is 10 gigabytes.

The Intel PCIe latest versions Flash drives are well worth the cost if you have the need.

[***Ctein*** *replies: Robert has brought up an important point, which is that all SSD's are not created equal (any more than rotating hard drives are). For example, as reported by Lloyd Chambers, the very first flash drives that Apple introduced into its computers were very poor performers, compared to the ones you could buy from companies like Other World Computing.*

I was gratified to see the SSD in my iMac could sustain a throughput around a gigabyte per second. That's nowhere near the best out there, as Robert points out, but it is respectable.

There are many websites out there that benchmark SSD's (Google will be your friend in this search). Don't just buy the cheapest; check out the performance specs first.]

Posted by: Robert Harshman | Tuesday, 01 September 2015 at 06:01 PM

This is extremely practical, accurate, and useful advice. Why?

The main performance bottleneck for system performance is usually the slowest I/O component. Start your optimisation efforts with storage, then memory, then CPU, in that order.

My other advice is to use the Performance Monitor in Windows 10/7/8 and the Activity Monitor on OSX, looking carefully at disk, memory usage, and CPU activity. They will tell you where you will need to upgrade next.

Cheers, Pak

[***Ctein*** *replies: Pak, in the case of Photoshop, more memory comes before anything else, because once you start swapping to disk you will inevitably experience a substantial slowdown. After that, the disk storage. Everything else is relatively small potatoes*]

Posted by: Pak-Ming Wan | Tuesday, 01 September 2015 at 06:20 PM

This is solid advice, especially the part about an internal SSD. Most people, myself included, are not very likely to need 32GB for Photoshop, but memory is cheap.

Does anyone besides me think that the fact that Photoshop can require a thousand images worth of RAM to process one single image indicates that the Photoshop programming team needs to learn about memory optimization?

The growth in code size and RAM requirements of both Photoshop and Lightroom is simply amazing. Lightroom CC (1.5GB) is more than 20 times the size of Lightroom 1 (65MB).

Since Adobe's subscription model is designed to reduce "upgrade churn" perhaps the folks who write the code will be able to spend some time optimizing both size and speed. That's just good programming practice.

Otherwise the Photoshop/Lightroom empire may just collapse under its own weight.

[***Ctein*** *replies: Randy, I'm guessing you don't make much, if any, use of image layers, snapshots or nonlinear history states. Stick with one layer, set the history to zero, turn off snapshots entirely. Stay away from all the automations. Avoid actions. You'll use less than 1 GB of RAM, even with large photographs.*

You'll also be eschewing capabilities that most serious Photoshop users make use of and that are pretty important to doing restoration work.]

Posted by: Randy Cole | Tuesday, 01 September 2015 at 08:05 PM

I use a late 2009 iMac with 4GB of memory that runs well enough editing FujiFilm X-Pro 1 files in Lightroom. A 180MB file like the one mentioned above would send my computer into fits, I'm sure. The latest Retina iMac with all the best options would cost me 5.5 Million Won. That's about two months' salary at a good job here in Korea. Yikes.
I usually use film and print at my very good local lab so I don't really need a new computer. Just out of curiosity, I calculated how many rolls of medium format Provia 100 with development I could get for the cost of a new iMac Retina. The answer is 305 rolls. Assuming no more price hikes by Fuji (ha ha) that's enough film for 4 or 5 years.

[***Ctein*** *replies: Marcus, yeah and it's about 1 month's very good salary here in the US of A. That's why I recommended the cost-effective options-- a few hundred for maxxed out RAM and a few hundred for an SSD. It gets you a lot more performance than a new machine.*

Coincidentally, our old iMac is the same model as yours, and it's a perfectly fine Photoshop powerhouse with 16 GB of RAM. As I wrote in my column about the Retina iMac a few weeks back, I didn't drop it for lack of performance but for the difficulty of getting it serviced.]

Posted by: Marcus Peddle | Tuesday, 01 September 2015 at 09:04 PM

Just in case anybody is curious how much ram and how many cores photoshop or lightroom can use, this spring I bought a HP Proliant DL580 G5 with 4 Quad core Xeon X7350 32GB of ram and raid 1+0 array of 4 146GB SAS drives. You know, if 4 cores are good 16 should be better.

I wasn't expecting this to be particularly fast (it only cost me about $150, uses about that much in electricity, sounds like an airliner taxiing with it's four power supplies, and really warms the place up), but I was curious how well Photoshop could take advantage of 16 cores.

I loaded up a file that is about 30,000 x 30,000 by 16 bit by 144 layers, and rotated it a little. This took quite a while. I looked at how many cores it was using and it was using about four cores at about 95 percent and a smattering of activity on the other cores. I don't remember exactly but I don't think I ever used more than about 26 gig of ram.

Kind of a letdown. I was using photoshop cs6 because I had an install disc, maybe CC is better.

On the other hand you can be editing in photoshop, exporting a few thousand images from a 300000 image catalog in lightroom, and have Quicktime compress them into a HD video file all at the same time and none of them are any slower than they would be on their own.

BTW, in my experiments with photoshop on Mac, Yosemite's memory compression makes things sort of unpredictable in terms of testing.

Posted by: hugh crawford | Tuesday, 01 September 2015 at 10:22 PM

Ctein,

Absolutely right. I use Lightroom almost exclusively. My point was not that Photoshop shouldn't have complex features for people like you, but that they're no excuse for flabby, bloated code and excessive memory use.

This viewpoint stems from youthful experience 40+ years ago deblurring images (albeit they were small monochrome images) on a PDP-10 with 64K words of RAM enroute to a PhD.

Back then there were at most 10 or 20 digital images available to work with. The joke was that you could therefore code any existing image in 5 bits...

Posted by: Randy Cole | Tuesday, 01 September 2015 at 11:52 PM

SSD's are superb, I have in my machine (hack) 2 one for OS and software and another for lightroom libraries and as a scratch disk, the second disk makes lightroom open almost instantly and speeds up photoshop as well. Someone I know whose iMac HD started playing up went over to using a Thunderbolt SSD and it worked well as the boot disk, far better than an internal spinning disk, they also added a second SSD to use as above and a third 512 to use for the current years work each made it quicker. For the scratch disk/Lightroom libraries you only need a small disk a 128gb is far more than enough and you are better to buy a faster one than a larger one. Unless you have a very fast raid I don't think spinning disks need anything faster than USB3 though, the bus speed is faster than the drive.

Posted by: alex | Wednesday, 02 September 2015 at 03:00 AM

Ctein, thank you for the advice on SSD (already have lots of RAM). I am running a beefy WIN 7 machine and a MacBook Pro, but thinking about buying a new Mac workstation in 2016. One thing that throws me with a Mac workstation is running the business application QuickBooks (QB) with it. I see you can convert a 2015 QB for Windows company file into QB for Mac, but the reviews online for QB Mac are not so good. Does anybody run QB for Mac and are happy with its performance?

[***Ctein*** *replies: Darr, consider running Windows in a virtual environment on your Mac, and then you won't have to switch accounting programs.*]

Posted by: Darlene Almeda | Wednesday, 02 September 2015 at 03:09 AM

Good advise (and happily what I had more or less done during my last 'ultimate' rebuild). But one variation ...

You say
"*get an internal SSD (solid state drive) and use it for your operating system, applications including Photoshop, and the scratch disk*".

But I understood the conventional wisdom was never have the scratch disk and application on the same disk. To that end I invested in 2 SSDs.

Now I'm guessing that apps and scratch on the same SSD will be significantly faster than 2 separate conventional drives, but my question is does the SSD technology mean that separate apps and scratch SSDs no longer offers any real benefit?

[***Ctein*** *replies: Colin, the conventional wsidom was created before SSDs. SSD's don't thrash. There still might be (lesser) bandwidth bottlenecks. Why don't you run the experiment and tell us! Download and install Lloyd's benchmarking actions and run it with the scratch drive being the primary SSD and with the scratch drive being the secondary SSD.*]

Posted by: Colin K Work | Wednesday, 02 September 2015 at 06:40 AM

Would there be measurable advantages to using an external SSD on a MacBook Pro (16 GB RAM, 1 TB HD) as a Photoshop scratch disk?

[***Ctein*** *replies: Burdette, that would depend upon what you're currently using for a scratch disk and the real speed of your external bus. I couldn't tell you.*

Pay note to what I said about not using one HD for everything (including the scratch space).]

Posted by: Burdette Parks | Wednesday, 02 September 2015 at 08:44 AM

I feel like the talk about SSDs is overblown. I've had three different system SSDs in my desktop, and bought my laptop with one, and they're nice, and get good benchmark results (if kind of weird!), but nothing like the kind of "night and day" reactions people are expressing. I used spinning system drives for a bit quite recently on my old and new desktops, and they were certainly somewhat slower than the SSDs.

I think my biggest upgrade at *this* point would be 10GB ethernet cards for my file server and desktop system, since the primary files are always remote. Not any time soon, though.

Posted by: David Dyer-Bennet | Wednesday, 02 September 2015 at 07:54 PM

Another advantage of having loads of RAM available: RAM drives.

When I'm working on sets of RAW images, and not doing `heavy lifting', but just going through the set doing general white balance corrections, selecting keepers, etc, I generally create a RAM drive big enough to keep all the RAW files, then work from that. It makes switching between files a lot quicker then if the system has to load them from disk each time. This is especially nice if you want to, for example, select a keeper from a range of nearly identical images.

Posted by: Bernard Scharp | Thursday, 03 September 2015 at 02:06 AM

The comments to this entry are closed.