

Adobe Photoshop CS5: 64-bit Performance and Efficiency Measures

How support for larger memory configurations improves performance of imaging workflows.

Executive Summary

This report presents the findings of a market-specific benchmarking project conducted by Pfeiffer Consulting for Adobe. The main aim of the research was to document the impact of 64-bit support on the performance and productivity of Adobe® Photoshop® CS5, compared to the previous release of the software, running on a 32-bit system, or with a common 4GB memory configuration. Over 240 individual performance and workflow benchmarks, covering both Mac and Windows platforms, and four different memory configurations, were conducted.

64-bit support. Photoshop CS5 offers 64-bit support on both Mac and Windows. (Windows 64-bit support was first introduced with Photoshop CS4.) 64-bit support can provide very significant productivity gains over Photoshop running on 32-bit systems or with lower memory configurations. The latest release was almost 15 times faster resampling a 2GB file on 64-bit Windows 7 than Photoshop CS4 on the 32-bit version of Windows 7.

Opening and saving files. Opening and saving large files was up to six times faster than on 32-bit Systems; generally, 64-bit support makes Photoshop operation more fluid and more efficient.

Processing large files. Processing large files was significantly faster when working with memory configurations of 8 GB or more: Processing a color-space conversion on a 2GB file took over 6 times as long with Photoshop CS4 on a 4GB Mac Pro then with 16GB of memory.

Key Benchmark Results: Average of 300 Performance Benchmarks



Chart based on the average of all 300 benchmarks on Mac and Windows conducted for this project. Reference value: Average time for Photoshop CS4 with 4GB of RAM. **Shorter is better.**

Key Benchmark Results: Best result (Resampling of a 2GB file)

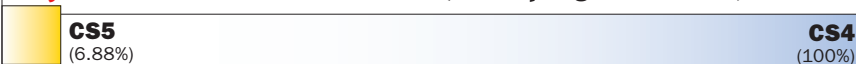


Chart showing the best result of 300 benchmarks on Mac and Windows conducted for this project. Reference value: Benchmark result for Photoshop CS4 on a 32-bit Windows 7 PC. **Shorter is better.**

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Introduction

About this Report

This report presents the findings of a market specific benchmarking project conducted by Pfeiffer Consulting for Adobe Systems, combined with technology analysis of the latest release of the Adobe tools for imaging professionals.

Productivity measures, based on the *Pfeiffer Consulting Methodology for Productivity Benchmarking*, analyzed performance and workflow productivity of Adobe Photoshop CS5, compared with the previous release of the software, specifically focusing on the impact of 64-bit support on efficiency in imaging workflows.

Additional research, covering key productivity features of Adobe Creative Suite® 5, as well as performance and productivity of Adobe CS5 Production Premium®, are covered in separate reports. For details on benchmark methodology and hardware configurations, please refer to the *Methodology* sidebar on page 4, or to the complete benchmark report (see sidebar).

Structure of this Report

This report is structured in 4 sections:

64-bit Computing for Creative Professionals (page 3) analyzes core aspects of 64-bit support for the creative pro market, and how Adobe Creative Suite 5 utilizes professional hardware configurations.

Photoshop Performance: Optimizing Hardware Support (page 5) looks at how Photoshop CS5 uses hardware resources of modern workstations, and how hardware performance can be optimized.

The Impact of Memory on Photoshop Productivity (page 7) provides a detailed analysis of the impact of different memory configurations on the performance of Photoshop CS5.

About Pfeiffer Consulting

Pfeiffer Consulting's mission is to provide unique high-level, international market intelligence and strategic consulting for both content and technology providers.

Pfeiffer Consulting is the publisher of the *Pfeiffer Report on Emerging Trends and Technologies*, an online resource on trends in the technology and content industry, as well as numerous specialized studies and reports.

For more information, please visit: www.pfeifferconsulting.com.

Major Findings

- ▶ The arrival of Adobe Creative Suite 5 marks **a major push for cross-platform 64-bit computing** in mainstream applications.
- ▶ Photoshop CS5 with 16GB of RAM was **almost 15 times faster** compared with the previous release running on a 32-bit system in some of the benchmarks for this project.
- ▶ Native 64-bit support of several Adobe CS5 applications allows multiple programs running in parallel **to share available memory in a highly efficient way**.

About Pfeiffer Consulting

- ▶ Pfeiffer Consulting is an **independent technology research institute and consulting operation** focused on the needs of publishing, digital content production, and new media professionals.
- ▶ Download the complete **Adobe Photoshop CS5 64-bit Benchmark Report** at pfeifferreport.com.



64-bit Computing for Creative Professionals

Major Points

- ▶ 64-bit support in key high performance applications of the Adobe Creative Suite, such as Adobe Photoshop CS5, Premiere Pro CS5 and After Effects CS5, **provides creative professionals with new ways of harnessing the power of modern computing hardware** and system software.
- ▶ Photoshop CS5 is the first release of the application that **supports extended memory configurations on both Mac and Windows platforms**. (Photoshop CS4 supported 64-bit on Windows only.)
- ▶ Benchmarks for this project show that **productivity gains linked to 64-bit support by Photoshop can be very significant**.

The New Hardware Frontier

64-bit computing is not an easy subject. There are more pieces to this puzzle than initially meet the eye; and while 64-bit computing is decades old and has been used in vertical applications and markets for a very long time, there is still a lot of confusion in the mainstream PC market as to the necessity and benefits of this upper echelon of computing hardware.

To make matters worse, even if 64-bit hardware and system software is far more common with creative professionals than with other parts of the personal computing market, only a relatively small number of software packages actually take advantage of 64-bit systems — and up to now, almost none of the most popular applications were among them.

The arrival of Adobe Creative Suite 5 is likely to change this situation: the fact that the latest release of several Adobe CS5 applications offers native support for 64-bit systems means that some of the most popular and widely used creative applications can now access the full hardware capacities of even the most powerful workstations common in this market, providing a considerable performance boost in areas such as digital imaging and video production; beyond these practical aspects, 64-bit support by key tools from Adobe also provides a considerable push for a technology that still needed some major endorsement in order to be widely adopted by creative professionals around the world.

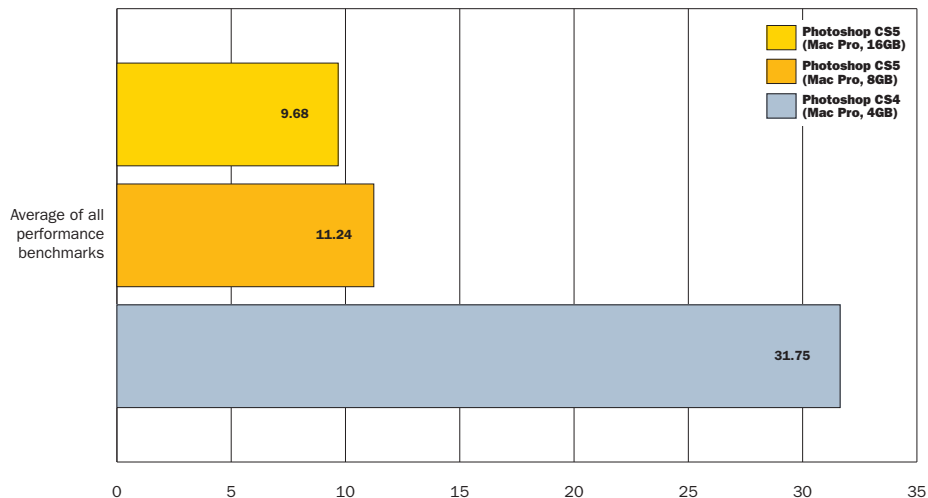
Why Memory Matters...

The availability of memory is one of the most important factors in computing performance. This is particularly true for Photoshop: This chart shows the average time for all performance benchmarks conducted on the Mac Pro platform, combining benchmark data of 28 individual benchmarks per memory configuration, using files ranging from 300MB to 2GB in size. Clearly, just doubling the available memory from 4GB to 8GB brings a very significant performance boost.

For more details on the impact of memory on Photoshop performance, please see page 7 of this report.

How Memory Impacts Photoshop Performance

Time scale in seconds. Shorter is better.



Methodology

This report is based on technology analysis and market-specific performance and productivity benchmarks conducted by Pfeiffer Consulting for Adobe Systems Incorporated.

Performance and Productivity Measures

Extensive performance measures analyzed the impact of cross-platform 64-bit support introduced in Photoshop CS5. Over 300 individual performance and workflow benchmarks, covering both Mac and Windows platforms, and four different memory configurations, were conducted.

Hardware and System Software

Windows: Two identical Dell Precision Windows 7 workstations equipped with 2.83GHz quad-core Xeon processors and with 4 to 32 GB of RAM, factory-configured respectively for 32-bit and 64-bit Windows.

Mac: 2.83GHz quad-core Mac Pro workstation equipped with 4 to 32 GB of RAM, running Mac OS X Snow Leopard 10.6.2.

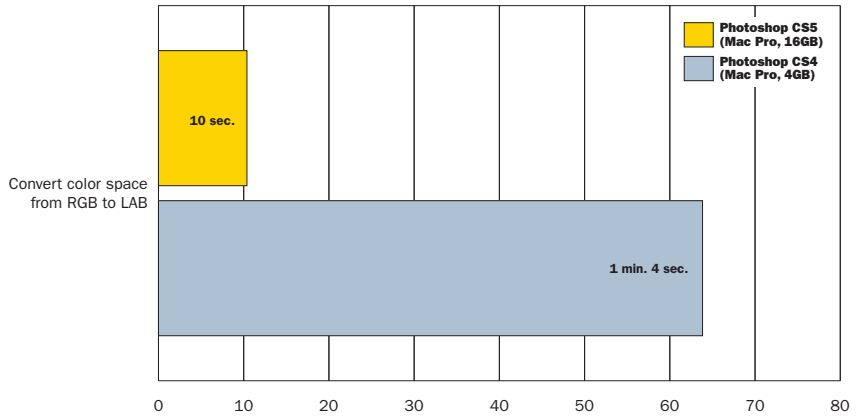
Nature of Productivity Benchmarks

Experienced professionals performed segment-specific workflow tasks and assignments, defined in clearly repeatable steps and executed in a closely monitored way.

All statements in this report are factual and can be independently verified. For in-depth discussion of the benchmark methodology, system configurations, and comprehensive benchmark description and results, **please download the complete “Adobe Photoshop CS5 64-Bit Benchmark Report”** at www.pfeifferreport.com.

Photoshop Performance — 2GB Image

Time-scale in seconds. Shorter is better.



64-bit support in Photoshop allows professionals to work much more efficiently with large files: the color space conversion measured in this test took just over ten seconds with Photoshop CS5 with 16GB of RAM, while it required over a minute with Photoshop CS4 with 4GB.

The Pieces of the Puzzle

At the most basic level, 64-bit computing means that the computer works with and can access much larger chunks of data than 32-bit systems. The potentially confusing aspect is that there are basically three different sides to the 64-bit story — processor, operating system, and application software — and only if the right aspects are aligned is there a tangible benefit. To add to the confusion, 64-bit systems are not any more powerful *per se* when doing routine tasks that would not require a 64-bit support.

Let's take a closer look:

64-bit processors: These processors, common in high-end PC and Mac Pro workstations have a 64-bit-wide hardware architecture that can access memory and process data in much larger chunks. To make full use of these capabilities, the computer needs to run the appropriate operating system (OS).

64-bit OS: In the case of the Mac OS X, the operating system has been 64-bit capable for many years (although few applications used this potential). Windows, on the other hand, exists in distinct 32-bit and 64-bit versions. If one uses, for instance, a 32-bit version of Windows 7 on a 64-bit workstation, the amount of memory that can be used will be limited by the operating system: even if you have 16GB of RAM installed on such a computer, the OS will only “see” 4GB.

64-bit Applications: Finally, only if an application is 64-bit capable can it use the full hardware capabilities of processor and operating system.

How Photoshop CS5 Fits Into the Picture

While office applications such as word processors or spreadsheets have no need for (and will see no performance benefit from) 64-bit architectures, Photoshop is one of the key applications that will see a significant performance boost from the possibility of using more available memory.

Photoshop CS5 is 64-bit native on both Mac and Windows platforms (Photoshop CS4 had 64-bit support on Windows only.) Windows versions of Photoshop require a 64-bit version of the OS to take advantage of this capability.

It is also important to note that 64-bit support will use available RAM even if the hardware architecture is not 64-bit. Photoshop CS5 running on a laptop or desktop computer with a 32-bit processor that has 8 or 16GB of RAM will be able to access all the available memory, as long as the operating system is 64-bit.

The performance and productivity gains linked to 64-bit support in Photoshop are very significant, as the benchmark results for this research project show.

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Photoshop Performance: Optimizing Hardware Support

Major Points

- ▶ **Photoshop provides extensive support for advanced hardware configurations**, including cross-platform 64-bit processing, support for GPU acceleration and parallel processing on multi-core processors to increase overall performance and efficiency.
- ▶ Photoshop CS5 with 16GB of RAM was **almost 15 times faster** than the previous release on a 32-bit system in some of the benchmarks for this project.
- ▶ Using Photoshop CS5 on 64-bit systems with 16GB of memory, **opening and saving large files can be up to six times faster** than on 32-bit systems.

Using All the Resources

From its inception two decades ago, Photoshop has been a program that could achieve amazing results — and can require significant computing power and hardware configurations.

But while Adobe's program always made good use of the processor speed and the throughput of the overall computing hardware and storage architecture, there are two aspects that are relatively recent additions to the resources Photoshop uses to increase efficiency: 64-bit support, and the processing power of the GPU, the graphics processors on the increasingly powerful video cards in modern workstations and laptops.

The Benefits of 64-bit Architectures

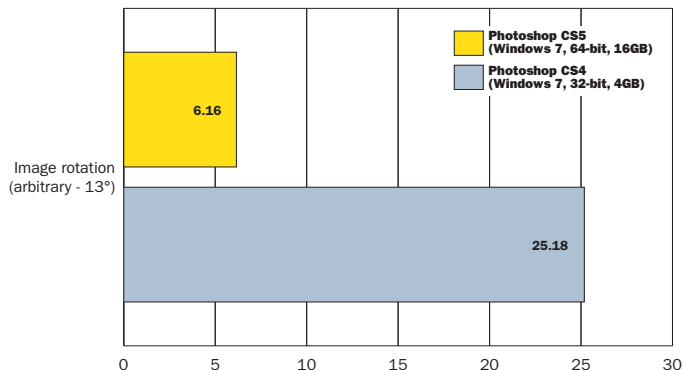
A first level of 64-bit support had been added to Photoshop with the CS4 version of the program; Photoshop CS5 is the first release that is fully 64-bit capable on both Windows and Mac.

This means that Photoshop users can now take advantage of the full amount of memory installed in a system — particularly important in the case of desktop workstations, which usually offer 4 to 8 memory slots, making RAM expansion a cost-effective way of boosting Photoshop performance. (More about the impact of memory on Photoshop performance on pages 7-8.)

Photoshop CS5: Key Benchmark Results

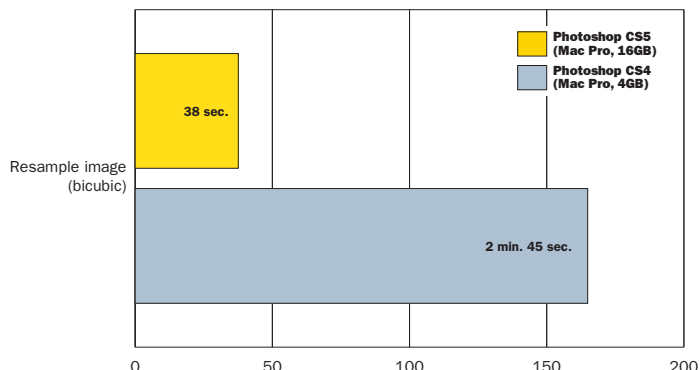
Photoshop Performance — 600MB Image

Time-scale in seconds. Shorter is better.



Photoshop Performance — 2GB Image

Time-scale in seconds. Shorter is better.



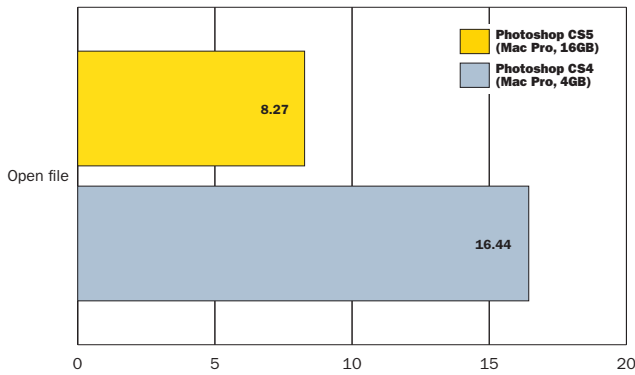
64-bit support (available on Windows since Photoshop CS4) allows the program to access available memory in modern workstations. As the chart on the left shows, the real bottleneck here is the 32-bit operating system.

On Mac OS, Photoshop CS5 is the first release to support 64-bit. Resampling a 2GB image took almost 3 minutes on a 4GB Mac Pro system; with 16GB of memory, Photoshop CS5 completed the same task in 38 seconds.

Photoshop CS5: Efficiency in Opening and Saving Large Files

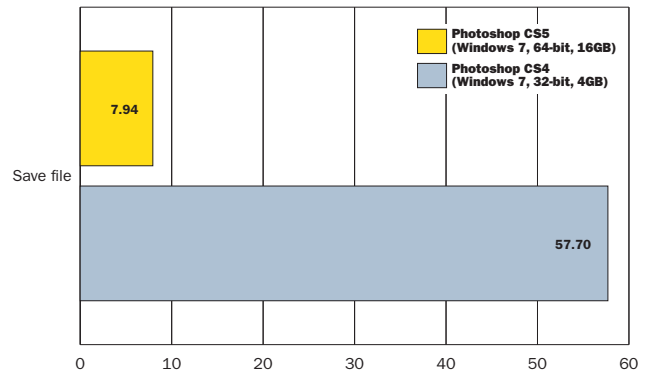
Photoshop Performance — 1GB Image

Time-scale in seconds. Shorter is better.



Photoshop Performance — 2GB Image

Time-scale in seconds. Shorter is better.



As soon as file-size increases, opening and saving files can become very time-consuming, and despite the fact that these operations are heavily dependent on hard-disk performance, 64-bit productivity gains are remarkable: the chart on

the left compares the time for opening a 1GB file on a Mac Pro with 4GB and 16GB of RAM; the chart on the right shows the time for saving a 2GB file. The 32-bit OS slows down Photoshop CS4, which is 64-bit capable on Windows.

Yet better use of memory for a single application is not the only way in which 64-bit architectures can increase overall efficiency: on a 64-bit system, with 8 or more gigabytes of RAM, applications running in parallel do not have to fight over the same memory space, and each one gets enough memory to function properly and efficiently.

The Importance of the Operating System

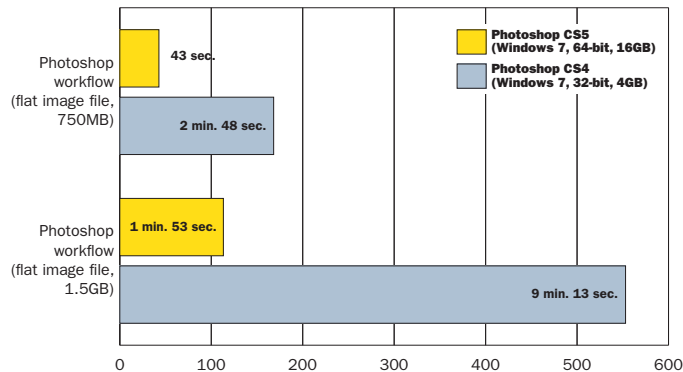
It is important to point out the impact of the 64-bit operating system for performance. In the Windows portion of the benchmarks for this project, we compared Photoshop CS4 running on a 32-bit version of Windows 7, equipped with 4GB of memory (the maximum amount this operating system recognizes) with Photoshop CS5 running on the 64-bit version of Windows, equipped with 16GB of memory.

As the benchmark results show, the performance difference between the two configurations is dramatic, especially for larger files; the key bottleneck in this set-up is of course the memory limitation of the 32-bit system; Windows users had access to 64-bit support since Photoshop CS4.

Photoshop CS5: Workflow Benchmarks

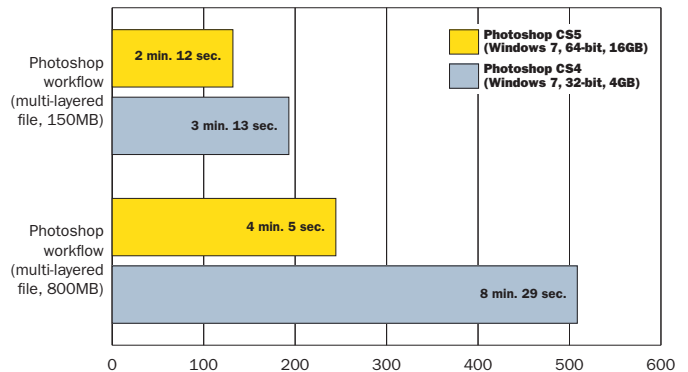
Photoshop Workflow Benchmarks — Flat Image Files

Time-scale in seconds. Shorter is better.



Photoshop Workflow — Complex Multilayered Files

Time-scale in seconds. Shorter is better.



Productivity gains of 64-bit system are also very significant in workflow benchmarks, which compare the total time necessary to open, apply several modifications, and save a file. The chart on the left shows the results for executing a

workflow scenario with flat image files, while the chart on the right shows the results for workflow benchmarks with complex, multi-layered Photoshop files. In both cases, the memory limitation of 32-bit Windows is the key bottleneck.

The Impact of Memory on Photoshop Performance

Major Points

- ▶ Added memory **provides a very significant performance and productivity boost** with Photoshop CS5, particularly when processing very large files.
- ▶ Using 16GB of memory, **Photoshop CS5 was almost five times faster** resampling a large image on a Mac Pro than the previous release with only 4GB of memory.
- ▶ High memory configurations (such as 16GB of memory or more) provide the additional benefit of **allowing several memory-intensive applications to efficiently run in parallel** without necessarily requiring virtual memory.

Can't Get Enough

Memory has always been a big deal for Photoshop users. As an image-processing, retouching and creation tool, Photoshop offers so many and such diversified tools and options, that creating increasingly complex files with a huge memory footprint is not only easy, it is the daily reality of thousands of creative professionals around the world.

Adding adjustment layers, effect layers and smart objects, not to mention 3D elements and countless other effects to even relatively small files requires serious processing power and a lot of memory. Without mentioning the added computing requirements for the creative possibilities of HDR images, one of the most exciting additions the CS5 release brings to the core Photoshop toolset.

Running Out of Memory... or Not

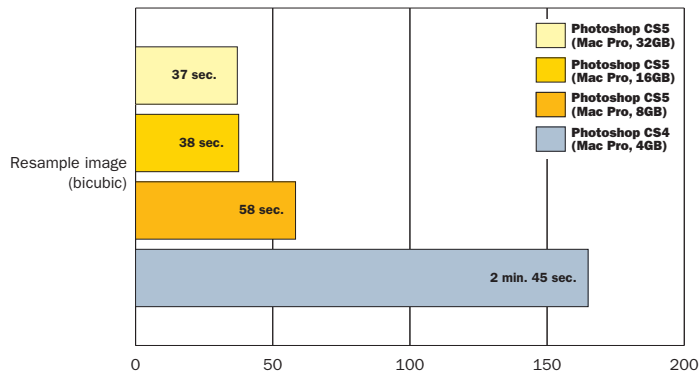
What happens when Photoshop runs out of memory is of course that it uses virtual memory instead — taking a heavy toll on the operational speed of the program. In other words, the importance of 64-bit support for Photoshop users cannot be stressed enough.

Not surprisingly, the difference in performance between a 4GB configuration running Photoshop CS4, and an 8GB or 16GB configuration with Photoshop CS5 when working with large files is spectacular. (It is interesting

Impact of Memory Configurations: Large Files

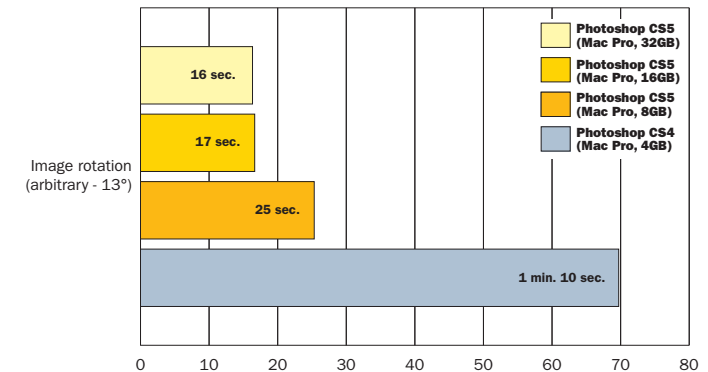
Photoshop Performance — 2GB Image

Time-scale in seconds. Shorter is better.



Photoshop Performance — 2GB Image

Time-scale in seconds. Shorter is better.



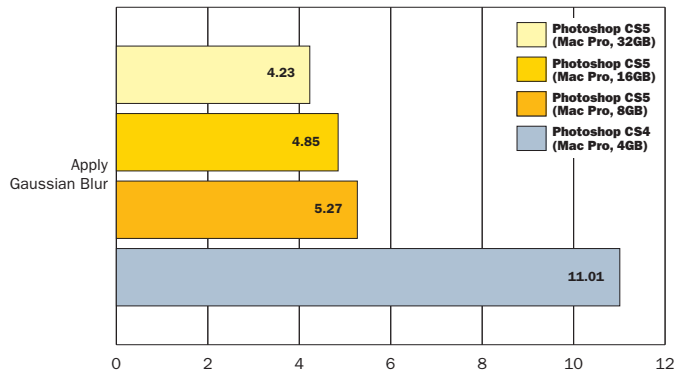
It is clear that the strongest impact of 64-bit support can be observed when working with very large image files. These charts show the difference of performance processing 2GB image files with varying memory configurations. While

the jump in efficiency from 4GB to 8GB is the most spectacular, high memory configurations definitely provide an additional speed-bump, particularly when using several memory-intensive application in parallel.

Impact of Memory Configurations: Medium Size Files

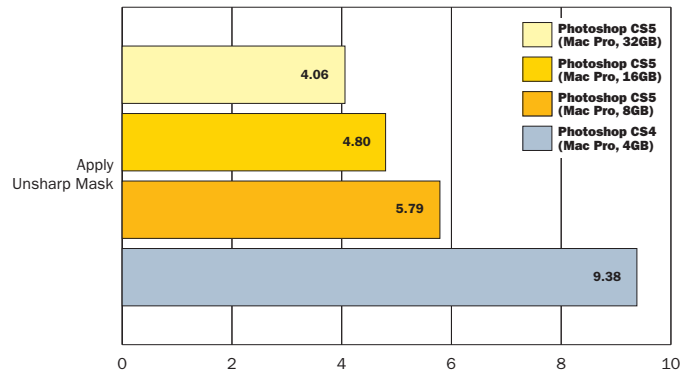
Photoshop Performance — 600MB Image

Time-scale in seconds. Shorter is better.



Photoshop Performance — 600MB Image

Time-scale in seconds. Shorter is better.



When working with medium size images, going from a 4GB to 8GB or more of memory almost doubled Photoshop performance in these benchmarks, while adding additional memory did not provide a strong performance boost, at least not

in this benchmark scenario, where only Photoshop is using available memory. In addition, memory fragmentation problems, similar in nature to disk fragmentation issues, are more likely to occur with lower configurations.

to note, however, that even working with relatively small files, that would not exceed available memory on a 2GB or 4GB configuration, Photoshop CS5 was still faster than previous releases in our benchmarks — even when using the same memory configuration as the older version.)

How Much Memory Is Enough?

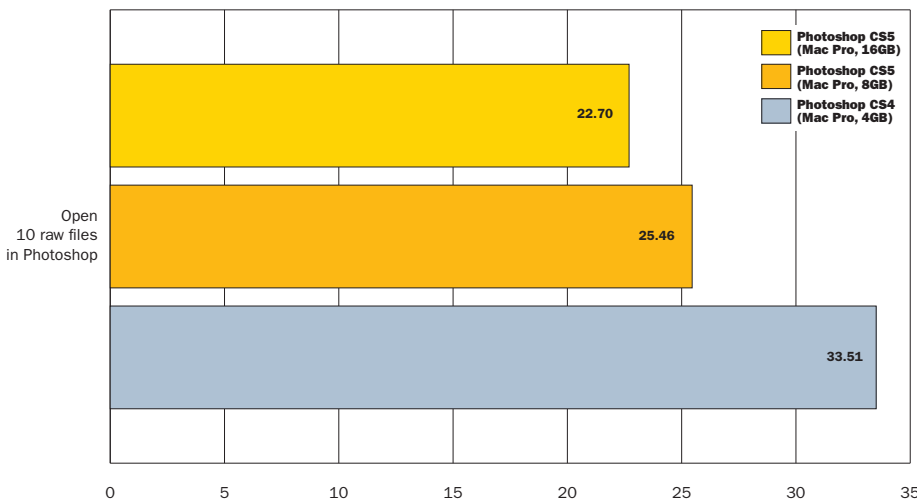
Expanding available memory beyond 4GB provides immediate benefits in efficiency. As the charts in this section underline, the biggest jump in performance will occur when moving from 4GB to 8GB or 16GB of RAM; benchmarks conducted with 32GB did show slight performance increases over 16GB configurations, but only when working with very large files.

On the other hand, these benchmarks were conducted in a single-application scenario — no other application than Photoshop was running during the tests. In workflow situations where Photoshop may be running alongside other creative applications such as After Effects, Premiere Pro, Illustrator or InDesign, higher memory configurations will yield clear benefits.

Impact of Memory Configurations: Raw Processing

Photoshop Performance — Raw Processing

Time scale in seconds. Shorter is better.



This chart shows the time necessary to process 10 high-resolution raw image files from a DSLR camera in Camera Raw, and to display them in Photoshop.

The most significant performance boost for this operation occurs when expanding the available memory from 4GB to 8GB; additional memory does not provide a comparable increase in performance in this benchmark.