

SSD Old System vs HDD New

SSD technology enjoys many advantages over traditional spinning disk / HDDs. No moving parts makes it more rugged, more resistant to shock and vibration but performance is undoubtedly the biggest benefit SSD technology brings to computing. The recent advances in CPU technology are impressive but in that same time advances in HDD performance have been relatively flat. Users typically experience performance in a system via latency or lack thereof. That is to say, if a system takes a long time to boot and the various applications take a long time to launch the system is said to be slow. At Kingston we understand how data flows in a system, The HDD is the main culprit in this case, the quicker a system can get data into RAM for the CPU to use the faster the system will be and SSD technology makes this possible.

Our theory was that we could take an older model system with an older / slower chipset and CPU and make it as fast or faster than a new system using the latest CPU technology but still using a HDD.

### **To test this we tested two notebooks, the specs are below**

- Lenovo T430s (June 2012) Intel Core i5 3320M 2.60 GHz
- 4GB DDR3 1066
- Tester 1 — Hitachi 320GB SATA 3.0Gbps 7200RPM
- Tester 2 — Hitachi 500GB SATA 6.0Gbps 7200RPM
- Windows 7 x64
- Lenovo T410 (January 2010) Intel Core i5 560M 2.66GHz
- 4GB DDR3 1066
- Kingston KC300 240GB SSD SATA 6.0Gbps
- Windows 7 x64

\* The KC300 is a SATA 3.0 SSD capable of delivering over 500MB/s bandwidth, the Lenovo T410 notebook is using a SATA 2.0 limiting drive performance to 300MB/s.

Both systems were installed with a fresh copy of Windows 7 with all the latest patches and updates and the latest device drivers from Lenovo's website were used to configure the system.

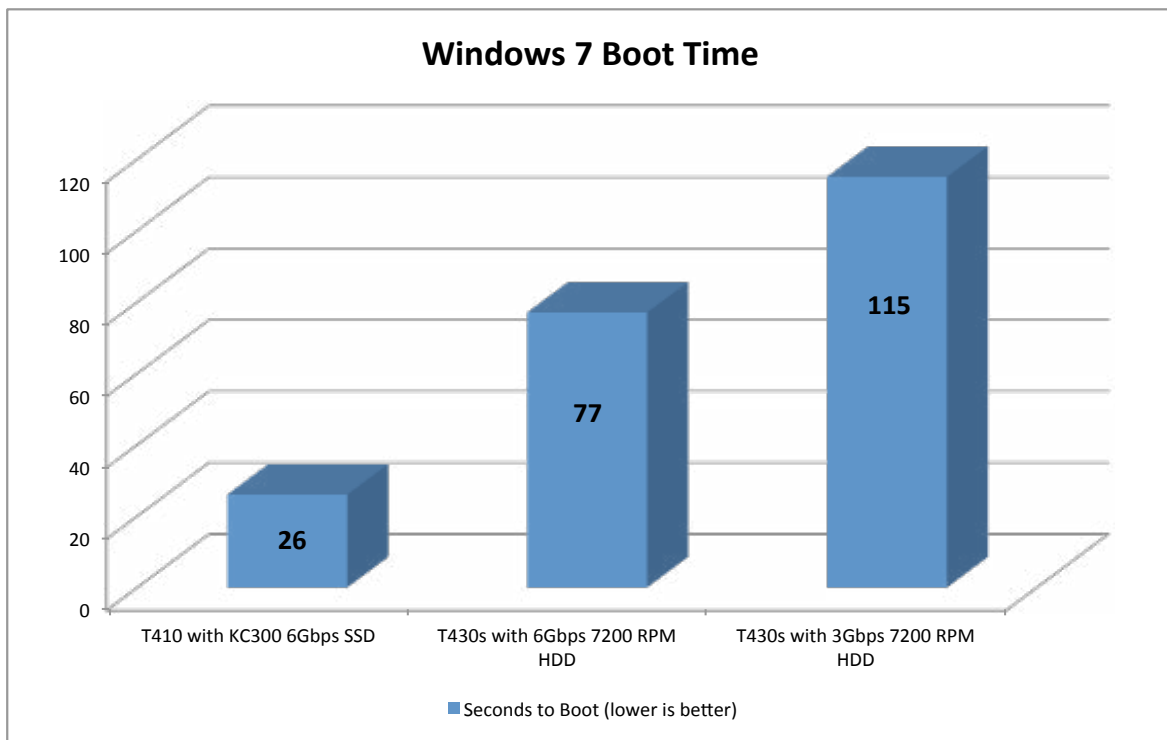
### **To test performance we did the following**

- Recorded boot times of each system
- Ran a batch file to open 50 files spanning multiple apps and recorded the time to open them
- Used Microsoft Security Essentials to run a full system scan comprising of over 300,000 files and recorded total time to complete the scan
- Ran the PCMark 7 Comprehensive system test to compare total performance of each system. PCMark 7 by Futuremark puts the test system through a series of workloads spanning digital media content creation, gaming, productivity, computation and storage. This popular benchmark will test CPU, RAM, Video and Storage and the faster the system finishes the workloads the higher the scores.

See below for the test results.

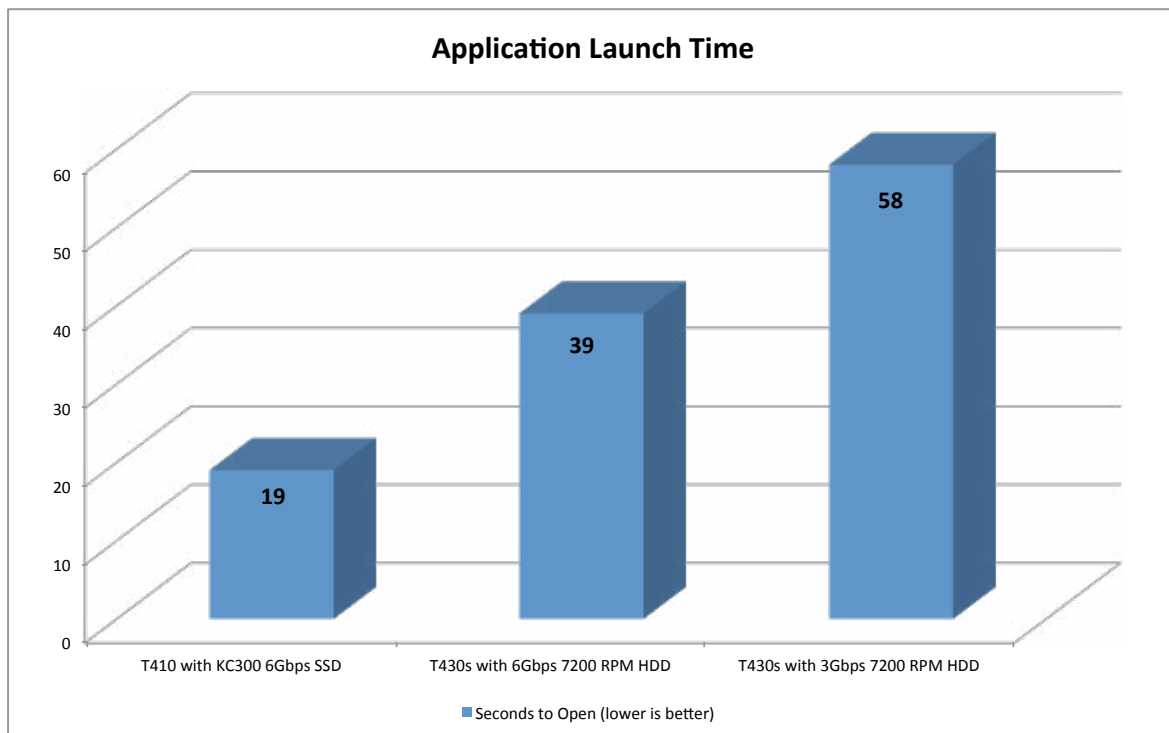
## Boot Times

The older Lenovo T410 with a SSD booted to desktop in less than half the time as the current generation laptop. Also bear in mind this was after a fresh install with a clean OS and registry. We would expect the hard drive based system would further slow down over time as apps are installed and various services enabled on the system. The SSD based system would undergo the same changes but with no moving parts on the SSD and much faster random access than a HDD we would expect the boot time delta to increase even further as the systems age.



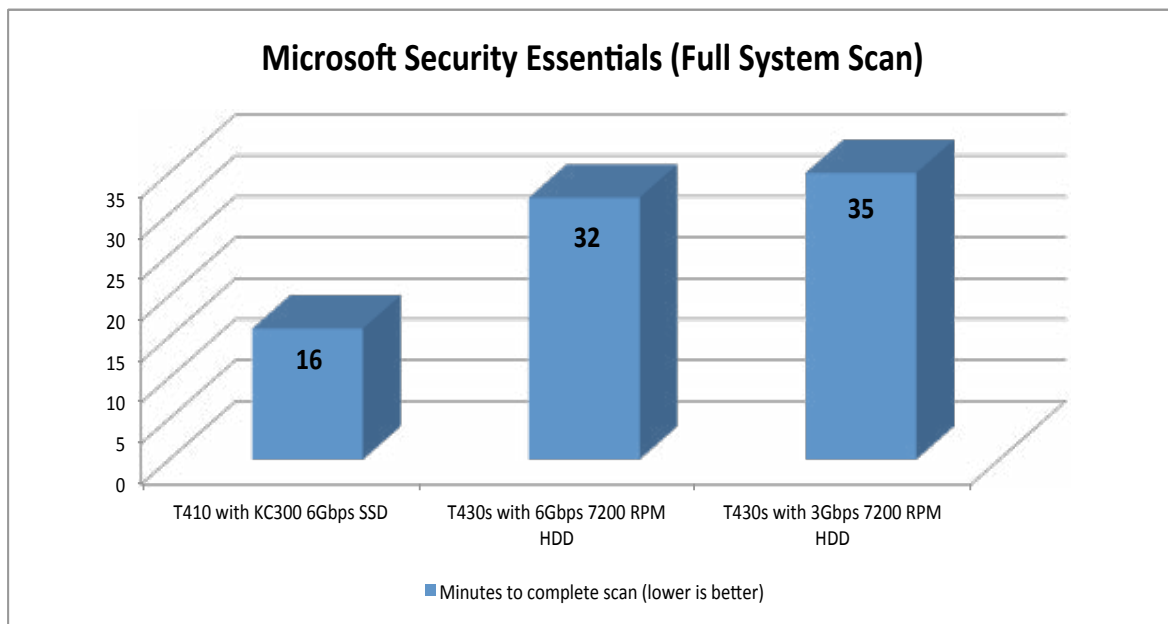
## Application Launching

We've all clicked on an icon to launch a program and watched that familiar hourglass icon come up while waiting for the application to start. The latency we experience is caused by waiting on the HDD to deliver the instructions for the program and files into RAM so the CPU can process it. To test this we wrote a script that would tell the system to open up 50 files simultaneously made up of the following Word, Excel, PowerPoint, PDF and JPG. The files ranged in size from 15KB to 51MB and we used a stopwatch to time how long it took each system to open up all 50 files and the applications that run them. As you can see below the older system with an older processor and SSD completed our application launch test in less than half the time as the newer system.



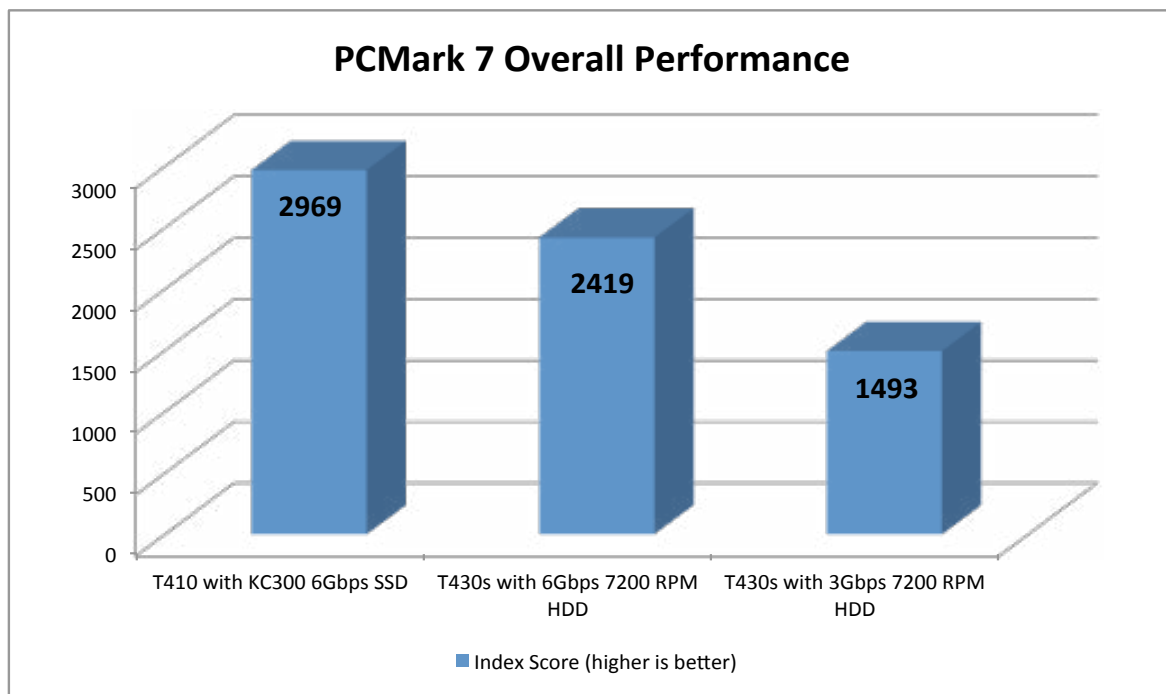
### Microsoft Security Essential Scan

Microsoft Security Essentials provides real-time protection for your home or small business PC that guards against viruses, spyware, and other malicious software. Security software of this kind, while absolutely necessary, can take up valuable system resources while running. A full system scan in particular can take quite a while so the faster it can be completed the quicker the user can return to using their system. A full system scan is quite disk intensive and a slower HDD can really impede this process. In our test below both systems underwent a full system scan made up of over 700,000 files. Once again the “older technology” Lenovo T410 notebook with a SSD completed the test in just sixteen minutes, a full sixteen minutes faster than the Lenovo T430 with a HDD.



## PCMark 7

PCMark from Futuremark is a publicly available benchmark and is widely used by various technology publications and the reviewer industry as a means of objectively measuring overall system performance. Along with overall performance this benchmark allows the user to individually test the performance metrics of the CPU, RAM, Video and Storage in a system. During the benchmark the system is put through various workloads including managing and creation of digital media content, processing of photos and videos, typical office applications, gaming and a computations test. The faster the system is able to complete all the workloads the higher the overall score. Looking at the results below we see that overall system performance increased by an impressive 36%. Of all the tests we ran this by far was the most impressive. Essentially we were able to take an older generation notebook, upgrade it with a SSD, and have it significantly outperform a notebook built with today's CPU and HDD technology.



See next page for the scores from the individual PCMark 7 Suites.



## Productivity Suite

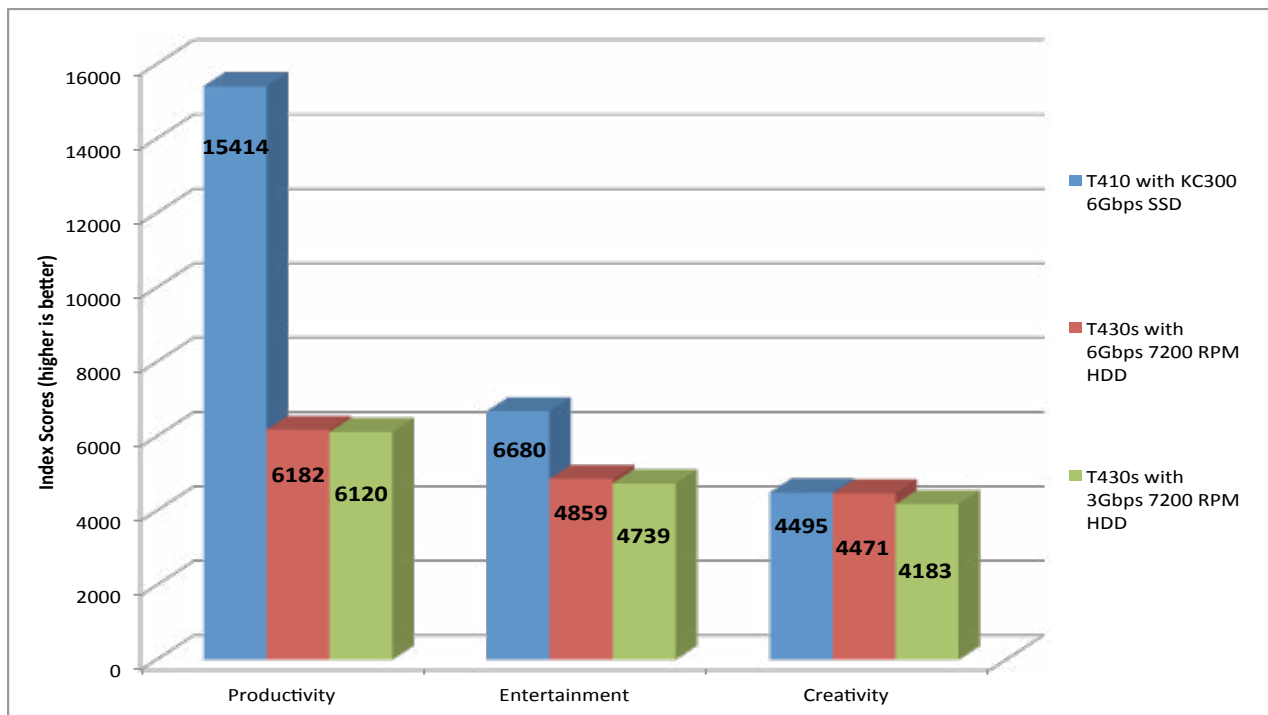
This workload represents typical consumer / office applications. Multiple page web browsing, malware scanning, word processing and opening multiple applications are all performed in this workload. In this test the SSD based system was over 235% faster than the newer notebook using a HDD.

## Entertainment Suite

The entertainment workload measures system performance specific to CPU and GPU intensive applications such as transcoding and gaming. In addition there is a storage component of this suite that enabled the SSD system to edge out the faster CPU and better graphics processor in the Lenovo T430.

## Creativity Suite

The Creativity workload measures system performance while creating, editing and storing photos and videos. Fast sequential and random storage is needed in this workload and the SSD Based Lenovo T410 won this benchmark by a 43% margin.



## Conclusion

Performance is the primary benefit SSD technology brings to computing. With superior sequential and random speeds, a SSD will improve the performance of any system both old and new. In this specific test we sought to prove that by upgrading an older system with a SSD we could in fact improve its performance equal to or greater than a newer laptop using the hard drive it came with. The tests we conducted proved that to be true. The SSD based system booted faster, opened up applications quicker and in a test of overall system performance outperformed the newer system using a HDD by an impressive 36%. This improvement in overall system performance is equivalent to a processor upgrade which is not very feasible with most notebook systems. We queried our corporate customers on why they upgrade their notebooks to a newer platform and by far the most given answer was lack of performance. Customers, both consumer and corporate, that are considering upgrading their notebooks to gain performance should instead upgrade their existing notebooks with a SSD. SSDs are by far most significant performance upgrade for old and new notebook computers.

## Workloads

The workloads we ran represented a typical employee's use of office applications, word processing, internet browsing, creation and managing of digital media such as pictures, movies and music. Such workloads depend on the performance of Storage, DRAM and CPU. Note that solely CPU and GPU intensive applications such as 3D Rendering and PC Gaming were not used for this benchmark. In those specific workloads it is our belief that the newer system with the most current CPU and GPU would be faster, however we believe that such workloads would most likely occur on a high performance desktop or workstation.