

WHY YOUR COMPUTER'S AGE MATTERS

Functionality and benchmark tests show the benefits of using newer Intel® Core™ processors

Executive Summary

Like an old pair of well-worn jeans, legacy computers are comfortable and familiar. They are known quantities and have been customized over the years to fit employees' job-related needs. However, that comfort could cost each employee about 2.65 workdays per year in lost productivity. Companies often tolerate older machines because they overlook the true impact to performance, energy savings, and productivity. Over time, the seconds and minutes an employee spends waiting for an old computer to finish processing a task can add up to days or weeks of lost productivity for the entire company. This paper explores how 6th generation Intel® Core™ processors can save companies time, money, and frustration with improved computing power, less energy consumption, and increased employee productivity.



Increase productivity
to save time



2.5x the performance,
or more, with a new processor



Consume 60% less power
than with legacy processors

Prowess conducted both functional and benchmark testing to compare the new, 6th generation Intel® Core® processor family and the legacy 3rd generation family. The functional testing captured the performance improvements we observed in desktops performing specific, real-world tasks. The benchmark test results allow us to extrapolate performance gains from specific tasks to wider use cases.

The Benefits of Upgrading to a Newer Processor

You might not know it, but you could be wasting about 2.65 work days every year just waiting for your old computer.¹ And so might the rest of your company's employees. This lost productivity can quickly add up to weeks or even months for companies if hundreds of employees wait for their computers for a few minutes per day.

Companies often put up with lagging, aging desktop clients because their true costs are diffused over hundreds or even thousands of employees.

Prowess Consulting assessed the costs incurred by companies that hold onto older desktop computers. We compared the productivity, performance, and energy consumption of a five-year-old, 3rd generation Intel Core i5-2400 processor to a 6th generation Intel Core i5-6500 processor.

Our test results show the benefits companies can achieve by running PCs with current-generation Intel® processors rather than legacy systems. These benefits include:

- **Productivity**—Computers we tested powered by 6th generation processors saved time in real-world scenarios, which contributes to generating entire extra days of productivity for employees each year.
- **Performance**—6th generation processors outperformed their older counterparts by over 2.5 times. Our benchmark test results illustrate how and why productivity gains are possible in real-world scenarios.
- **Energy Savings**—6th generation computers in our tests used up to 60 percent less power, which can help companies reduce energy costs.

Where the Rubber Meets the Road: Analysis of Test Results

While most people assume that a newer processor would outperform an older one, the scope and magnitude of the differences are worth noting because they turn that underlying assumption into a business case for upgrading.

New Processors Deliver Productivity Gains

Computers only support employee productivity when the computers themselves stay out of the way. Starting computers, waiting for applications to load, and watching an icon spin while performing a compute-intensive task all waste employee (and company) time. And in more ways than one: not only are employees not performing the primary tasks for which they need



Get back **21 hours per year per employee** by upgrading old hardware.

their computers, but employees must spend time mentally shifting gears as they try to multitask to do something productive while waiting on their computers.

These short times add up. Companies where employees waste even as little as five minutes per day waiting for old technology lose almost three workdays over the course of a year, per employee. For an organization of 5,000 employees, this means that old IT is like having over 50 employees on the payroll that do nothing.¹

Using common productivity tasks, Prowess Consulting performed a series of functional tests that compared a computer powered by a legacy, 3rd generation Intel Core i5-2400 processor to a new mini-desktop powered by a 6th generation Intel Core i5-6500 processor. The processor generation was the only major configuration difference between the two computers. Not surprisingly, we discovered several tasks where the upgraded processor resulted in large performance gains. However, the extent of the performance gains and other benefits was a surprise.

Faster Start Up

For many users, starting up the computer can be a get-up-and-get-a-cup-of-coffee-sized wait. A current processor can help with that: the 6th generation processors spend 80 percent less time starting up—a savings of over 60 seconds.

For many users, another part of their morning rituals is to open Microsoft® Outlook® as soon as their desktop loads. New processors can help: the computer powered by the 6th generation Intel Core i5 processor opened Outlook with a large (5 GB) mailbox over six times faster (see Appendix A for full test results). Opening Microsoft® Office files shortly after startup is another common activity where users can recapture lost time in their day when they use a 6th generation Intel Core processor: the 6th generation processor was almost six times faster opening Microsoft® Word and Microsoft® PowerPoint® files.

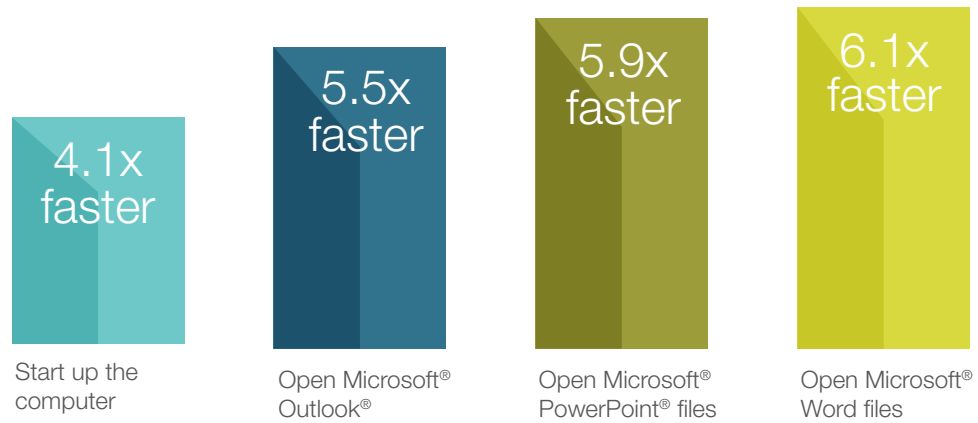
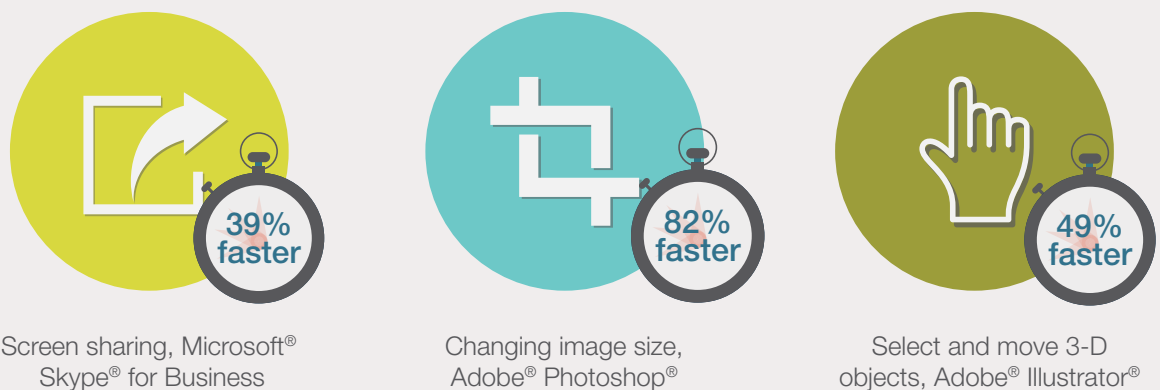


Figure 1. Performance improvement of common tasks on a 6th generation processor over the legacy, 3rd generation processor in functional testing (higher is better)

As seen in Figure 1, organizations can expect to reduce wait time and user frustration associated with common tasks when they upgrade legacy computers to devices powered by 6th generation Intel Core processors. Users should see improvements in everyday tasks such as computer startup time and faster opening of Microsoft Office files.

Faster collaboration and media-editing

Increase the productivity of collaboration and media editing



Fewer Delays in Collaboration

Processor performance also matters for collaboration. For example, employees and meetings often depend on the ability to share screens across a network connection. The new PC tested by Prowess established screen-sharing 38 percent faster than the legacy PC. Even small time savings add up: if employees have an average of three ad-hoc screen-sharing sessions with two other colleagues every day, the current-generation processor saves an hour of productivity per employee per year.²

Smoother Media Editing

Productivity, collaboration, and startup are not the only areas where new processors can markedly speed completion of workers' tasks. Another common task, especially for information workers in creative roles or departments, is to edit media. Changing the size of a large image in Adobe® Photoshop® was nearly twice as fast with the 6th generation processor. In Prowess testing, that translated into a 47-second savings.

Processor-intensive actions in Adobe® Illustrator® were also faster with a newer processor. For example, moving several three-dimensional (3-D) objects took nearly a third less time with the 6th generation processor. These time savings appear small, but remember that the actions they measure are common tasks, repeated many times per day by workers in creative roles. Improvements of seconds quickly become minutes of regained productivity when repeatedly moving objects in Illustrator or making adjustments to large image files in Photoshop.

Benchmark Tests Support Functional-Tests Results

The PC running the 6th generation Intel Core i5 processor scored consistently higher than the PC running the legacy, 3rd generation Intel Core i5 processor across industry-standard benchmarks (see sidebar). As expected, the 6th generation–powered PC had the greatest improvement (162 percent) in the graphics-heavy Futuremark® 3DMark® Ice Storm test. However, it was also 66 percent more capable than the legacy processor in media creation (Principled Technologies® HDXPRT 2014) and performed nearly twice as well (97 percent higher score) in the general BAPCo® SYSmark® 2014 benchmark.

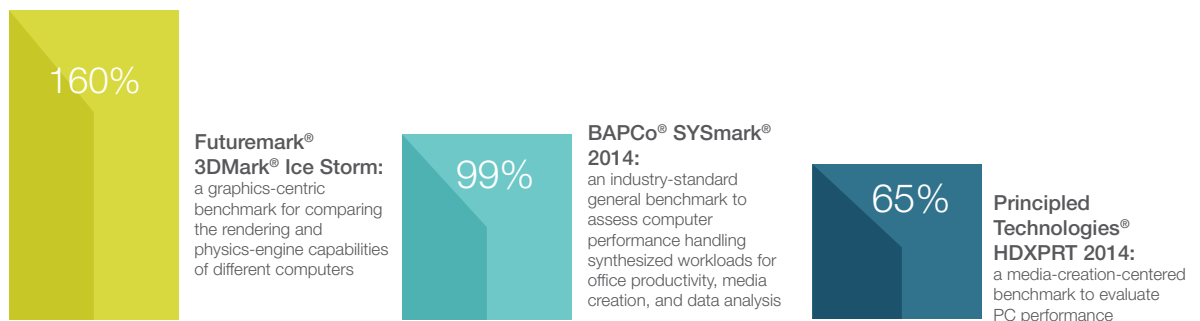


Figure 2. Percent benchmark improvement, 6th generation versus legacy, 3rd generation processors (higher is better)

Higher scores on these benchmarks indicate better performance on targeted measurements. Greater performance can also strengthen employee productivity in the form of greater capabilities. More capable PCs mean that employees can do more with the tools they rely on to get their work done. For example, they can tackle larger, more sophisticated spreadsheets and handle more complex presentations with less wasted time and less frustration. Greater processor performance can also translate to more capable multitasking: workers can have more tabs open on browsers, more files open on desktops, more of everything running in the background without processes slowing down. When employees are free to create and innovate rather than wait for their PC, they can be more productive and deliver better value to the company.

6th Generation Processors Can Help Reduce Energy Costs

One of the most tangible ways in which newer computers can help reduce operational expenses is through reduced energy consumption. Excluding monitors, the HP® EliteDesk® 800 G2 SFF, powered by a 6th generation Intel Core processor, used 52 percent less power while idle and 60 percent less power under load than the Lenovo® ThinkCentre® M91p DH7, powered by a legacy, 3rd generation Intel Core processor. This translates into average savings of approximately 10 W, or over \$45,000 per year for a company running 5,000 legacy desktop PCs.³

When we include monitors in the testing, 6th generation processors still save energy. Prowess compared the Lenovo ThinkCentre M800Z all-in-one computer, powered by a 6th generation Intel Core processor, to the ThinkCentre M91p DH7, powered by a 3rd generation Intel Core processor. The 6th generation processor-powered ThinkCentre M800Z all-in-one used 26 percent less energy while idle and 42 percent less energy under load. This works out to an average power savings of almost 13 W per computer per year. That translates into a savings of more than \$57,000 per year for a company with 5,000 computers.⁴

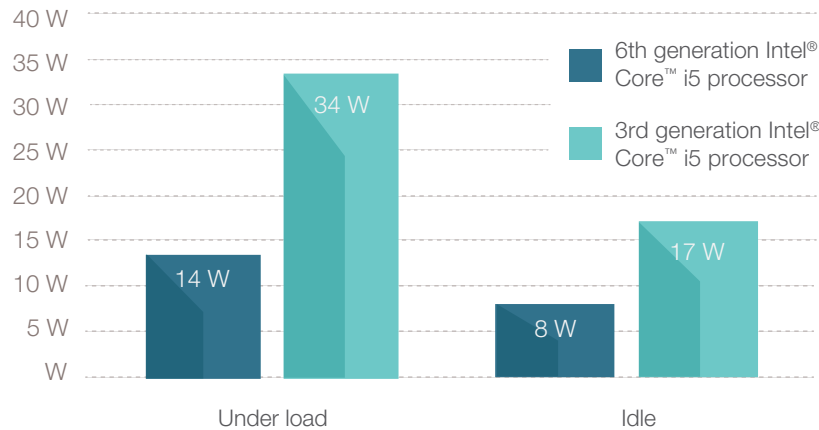


Figure 3. Comparison of average power use between 6th generation Intel® Core™ i5 processor and legacy, 3rd generation Intel Core i5 processor (lower is better).

All-in-one computers can make sense as a form-factor upgrade from legacy computers. The integrated monitor reduces the desktop footprint of the PC, and all-in-ones powered by 6th generation Intel® Core™ processors can provide additional built-in functionality like touch screens and wireless connectivity. Features like these can make sense in use cases where traditional PCs have been more awkward to deploy, such as in kiosks, point-of-sale (POS) terminals, or in temporary office spaces that need to be stood up and taken down quickly, all while being extremely energy efficient.



New Computers Save Time and Energy

Companies of all sizes that put off upgrading hardware until absolutely necessary might end up shortchanging themselves in the long run. As this study demonstrates, new processors can provide productivity gains and operational savings that companies might not realize they are missing out on until they are forced to upgrade.

As our testing of the 3rd generation Intel Core i5-2400 processor and the 6th generation Intel Core i5-6500 shows, companies with computers based on 6th generation processors can reduce operational costs as a direct result of decreased energy consumption—over 60 percent in some cases. In addition, new processors exceeded the performance of their legacy cousins by over 2.5 times in industry-standard benchmarks. That performance matters. Faster processing means that employees spend less time waiting for their desktop computer to boot or run a task, potentially adding up to 2.65 extra days of productivity from employees each year.

Why not seize these benefits sooner rather than later? Based on our test results and the ever-present business need to do more with less, Prowess Consulting recommends that organizations replace aging PCs with newer, more efficient technology today.

Appendix A: Hardware and Test Environment

| Devices | | | |
|--------------------------------|--|--|--|
| Maker | Lenovo | HP | Lenovo |
| Model | Lenovo® ThinkCentre® M91p DH7 | HP® EliteDesk® 800 G2 SFF | Lenovo ThinkCentre M800Z |
| Processor | Intel® Core™ i5-2400 processor, 3.10 GHz | Intel Core i5-6500 processor, 3.20 GHz | Intel Core i5-6500 processor, 3.20 GHz |
| Cache | L2-1024 KB, L3-6144 KB | L2-1024 KB, L3-6144 KB | L2-1024 KB, L3-6144 KB |
| RAM | 4 GB | 4 GB | 4 GB |
| OS | Windows® 7 Professional 64-bit | Windows 10 Pro | Windows 10 Pro |
| Graphics | Intel® HD Graphics | Intel HD Graphics 530 | Intel HD Graphics 530 |
| Hard Drive | HDD | HDD | HDD |
| HD Size | 465.76 GB | 119.24 GB | 465.76 GB |
| Wireless | Not Applicable (N/A) | N/A | Intel® Dual Band Wireless-AC 8260 |
| Software | | | |
| Microsoft® Outlook® | 16.0.6366.2036 | 16.0.6366.2036 | - |
| Microsoft® Excel® | 16.0.6366.2036 | 16.0.6366.2036 | - |
| Microsoft® PowerPoint® | 16.0.6366.2036 | 16.0.6366.2036 | - |
| Microsoft® Word | 16.0.6366.2036 | 16.0.6366.2036 | - |
| Microsoft® Skype® for Business | 16.0.6366.2036 | 16.6326.1010 | - |
| Google™ Chrome™ | 48.0.2564.82 m | 44.0.2403.89 m | - |
| Adobe® Photoshop® | 2015.1.1 | 2015.1.1 | - |
| Adobe® Illustrator® | 2015.2.0 | 2015.2.0 | - |
| Google Earth™ | 7.1.5.1557 | 7.1.5.1557 | - |

| Power Monitor | |
|---------------|-----------------------|
| Maker | P3 International |
| Model | P4400.01 Kill A Watt® |

| Network Speed | |
|---|-------------|
| Unless otherwise indicated, our tests were performed while devices were connected to an 802.11n wireless network. Network throughput fluctuates continually. We recorded network speeds at several points during the testing, and averaged the results. Averages values are shown here. | |
| Upload Speed | 24.14 Mbps |
| Download Speed | 119.42 Mbps |
| Ping | 10 ms |

Appendix B: Functional Test Steps and Results

Computer startup

1. Push the power button, and then start the timer.
2. End the timer when the logon screen appears.

Windows® logon

1. Enter the password, press Enter, and then start the timer.
2. Stop the timer when the Windows desktop appears.

Outlook (5 GB mailbox, immediately after startup)

1. From the task bar, click **Outlook**, and then start the timer.
2. Stop the timer when Outlook is completely opened and loaded.

Excel (26 MB file, no other Office applications running, one minute after startup)

1. Open the Excel file, and then start the timer.
2. Stop the timer when the file is fully opened and loaded.

PowerPoint (55 MB file, no other Office applications running, one minute after startup)

1. Open the PowerPoint file, and then start the timer.
2. Stop the timer when the file is fully opened and loaded.

Word (24 MB file, no other Office applications running, one minute after startup)

1. Open the Word file, and then start the timer.
2. Stop the timer when the file is fully opened and loaded.

Excel (26 MB file with the Excel already running)

1. Within an open Excel file, click **File**.
2. Click **Open**.
3. Select the Excel file and then start the timer.
4. Stop the timer when the file is fully opened and loaded.

PowerPoint (55 MB file with PowerPoint already running)

1. Within an open PowerPoint file, click **File**.
2. Click **Open**.
3. Select the PowerPoint file and then start the timer.
4. Stop the timer when the file is fully opened and loaded.

Word (24 MB file with Word already running)

1. Within an open Word file, click **File**.
2. Click **Open**.
3. Select the Word file and then start the timer.
4. Stop the timer when the file is fully opened and loaded.

Saving a Word file (24 MB file)

1. Within the open Word file, click **File**.
2. Click **Save As**.
3. Type a number at the end of the file name, click **OK**, and then start the timer. (In our tests, we used the numbers 2, 3, and 4.)
4. Stop the timer when the save bar at the bottom of the screen fills.

Saving an Excel file (26 MB file)

1. Within the open Excel file, click **File**.
2. Click **Save As**.
3. Type a number at the end of the file name, click **OK**, and then start the timer. (In our tests, we used the numbers 2, 3, and 4.)
4. Stop the timer when the save bar at the bottom of the screen fills.

Saving a PowerPoint file (55 MB file)

1. Within the open PowerPoint file, click **File**.
2. Click **Save As**.
3. Type a number at the end of the file name, click **OK**, and then start the timer. (In our tests, we used the numbers 2, 3, and 4.)
4. Stop the timer when the original slides show once more (and you no longer see the Save As screen).

Screen sharing with Skype for Business

1. Double-click the contact with whom you wish to share your screen.
2. At the bottom of the screen, click the **Present** icon.
3. Select **Desktop**.
4. Click **OK**, and then start the timer.
5. Stop the timer when the connection has been established (which is displayed at the top of the screen-sharing window).

Google Maps

1. Open **Chrome**.
2. Search for **Google Maps**.
3. In the search results, click **Google Maps**.
4. In the **Search** field, type **Washington, DC**.
5. Press Enter, and then start the timer.
6. Stop the timer when the map is fully loaded.

Switching to Google Earth in Google Maps

1. From the bottom, click the **Earth** icon, and then start the timer.
2. Stop the timer when the map fully loads.

Google Earth application

1. Open **Google Earth**.
2. Wait until the Earth finishes revolving.
3. From the left, click **Sightseeing Tours** to expand the list.
4. Double-click the Eiffel Tower tour, and then start the timer.
5. Stop the timer when the image fully loads.

Adobe Photoshop (113 MB file)

1. Open **Photoshop**.
2. Open the Photoshop file.
3. Click the **Image** menu.
4. Click **Image Size**.
5. Change **Pixels** to **Percentage**.
6. In the **Percentage** field, type **300**.
7. Click **OK**, and then start the timer.
8. Stop the timer when the bar fills up and disappears (the image may or may not resize immediately).

Adobe Illustrator (129 MB file, multiple 3D elements)

1. Open **Illustrator**.
2. Open the Illustrator file.
3. Drag to select all 3-D items.
4. Press the down-arrow key 10 times, and then start the timer.
5. Click outside the selected area.
6. Stop the timer when all items are deselected.

| Functionality-Testing Results | Lenovo® ThinkCentre® M91p DH7 (legacy 3rd generation processor) | HP® EliteDesk® 800 G2 SFF (6th generation processor) |
|--|--|---|
| Start | | |
| Start computer. | 75.35 seconds | 14.70 seconds |
| Open Microsoft® Outlook® | | |
| Open Outlook with a large mailbox. | 20.14 seconds | 3.13 seconds |
| Open Microsoft® Office® | | |
| Open a Microsoft® Excel® file on startup (with no other Office applications open). | 19.55 seconds | 10.85 seconds |
| Open a Microsoft® PowerPoint® file on startup (with no other Office applications open). | 16.99 seconds | 2.46 seconds |
| Open a Microsoft® Word file on startup (with no other Office applications open). | 17.65 seconds | 2.46 seconds |
| Open Office files | | |
| With Excel already running, open an Excel file. | 11.39 seconds | 6.36 seconds |
| With PowerPoint already running, open a PowerPoint file. | 2.00 seconds | 2.23 seconds |
| With Word already running, open a Word file. | 1.41 seconds | 1.45 seconds |
| Save large Office files | | |
| Save a Word file. | 1.48 seconds | 1.40 seconds |
| Save an Excel file. | 5.86 seconds | 4.70 seconds |
| Save a PowerPoint file. | 2.16 seconds | 1.91 seconds |
| Screen sharing | | |
| Establish a screen-sharing session between two PCs using Microsoft® Skype® for Business. | 5.33 seconds | 3.85 seconds |
| Adobe® Photoshop® | | |
| Change the image size to 300 percent (with no 3-D elements or font issues, using the file Test_Photoshop_File3). | 104.21 seconds | 56.70 seconds |
| Adobe® Illustrator® | | |
| Select all objects and move them 10 increments down by using the keyboard. | 8.03 seconds | 5.43 seconds |

Appendix C: Benchmark Test Steps and Results

3DMark

1. Start the system. (Restart before each test.)
2. Click the **Start** menu.
3. In the **Search** bar, type **CMD**.
4. Right-click the **Command Prompt** application.
5. Click **Run as Administrator**.
6. On the command line, type **CMD.exe / c start /wait Rundll32.exe advapi32.dll, ProcessIdleTasks**.
7. Let the system run through all idle tasks. Do not disturb the system during this.
8. When the command prompt appears, start a five-minute timer.
9. Once the timer is finished, double-click the **3DMark** desktop icon.
10. At the 3DMark screen, scroll down to **Ice Storm**, and then click **Run**.
11. When the benchmark is complete, record the scores, and then restart the system for next run.
12. Repeat steps 1–11 for each run.

SYSmark 2014

1. Double-click the desktop icon to launch SYSmark 2014.
2. Make sure that **Office Productivity**, **Media Creation**, and **Data/Financial Analysis** are selected.
3. Enter a **Project Name**.
4. Select three iterations, select the check boxes for **Conditioning Run** and **Process Idle Tasks**, and then click **Run Benchmark**.
5. When the benchmark completes, record the results.

Note: You can also click **Save FDR** to create a report.

Notes on working with SYSmark 2014:

1. SYSmark 2014 is not compatible with the following applications. If these applications are on the system, they need to be removed before SYSmark 2014 is installed.
 - a. Adobe® Acrobat® XI Pro
 - b. Adobe Photoshop CS6 Extended
 - c. Adobe® Premiere® Pro CS6
 - d. Google Chrome
 - e. Microsoft Excel 2013
 - f. Microsoft OneNote 2013
 - g. Microsoft Outlook 2013
 - h. Microsoft PowerPoint 2013
 - i. Microsoft Word 2013
 - j. Trimble® SketchUp® Pro 2013
 - k. WinZip® Pro 17.5
2. Disable the user account's password before running SYSmark 2014.
3. If you accidentally uninstall any of the software that SYSmark 2014 installs, or if you need to remove SYSmark 2014 for any reason, you will need to wipe the system and install a fresh copy of your operating system.
4. Windows 10 systems need a hotfix to run without encountering any errors that will stop the run.

HDXPRT 2014

1. Double-click the **HDXPRT** desktop icon.
2. Click **Run HDXPRT**.
3. Enter a **Test Name**.
4. In **Iterations**, type **1**, and then click **Run**.
5. Once the benchmark is complete, record the results.
6. Restart the system.
7. Repeat steps 1–6 for next run.

| Benchmark | Lenovo® ThinkCentre® M91p DH7 (legacy 3rd generation processor) | HP® EliteDesk® 800 G2 SFF (6th generation processor) |
|---|--|---|
| Futuremark® 3DMark® Ice Storm | 19,404 | 50,915 |
| Graphics score | 16,918 | 50,386 |
| Physics score | 40,120 | 53,060 |
| BAPCo® SYSmark® 2014 (Overall) | 797 | 1,568 |
| Scenario rating—Office Productivity | 1,041 | 1,302 |
| Scenario rating—Media Creation | 355 | 1,677 |
| Scenario rating—Data/Financial Analysis | 1,373 | 1,767 |
| Principled Technologies® HDXPRT 2014 | 104 | 173 |
| Edit photos (minutes) | 1.94 min. | 1.51 min. |
| Convert videos (minutes) | 2.44 min. | 0.79 min. |
| Edit music (minutes) | 1.97 min. | 1.67 min. |

Appendix D: Power Test Steps and Results

Power idle (without monitor)

1. Make sure that the user account's password is disabled and the system is turned off before starting.
2. Plug the tower's power cord into a Kill A Watt® meter.
3. Plug the Kill A Watt meter into a wall outlet.
4. Press the system's power button to start the system.
5. Once the desktop appears, click **Start**, and then, in the **Search/Run** field, type **CMD**.
6. Right-click the **Command Prompt** application.
7. Click **Run as Administrator**.
8. Type **CMD.exe(space)/c(space)start(space)/wait(space)Rundll32.exe(space)advapi32.dll,(space)ProcessIdleTasks**.
9. Let the system run through all idle tasks. Do not disturb the system during this.
10. Once the command prompt appears, start a five-minute timer.
11. Once the timer is complete, start an hour timer.
12. At the end of the hour, record the kWh and time (duration).

Power idle (with monitor)

1. Make sure that the user account's password is disabled, the screen brightness on the monitor is set to the highest possible setting, and the system is turned off before starting.
2. Plug the tower's power cord and the monitor's power cord into a power strip.
3. Plug the power strip into a Kill A Watt meter.
4. Plug the Kill A Watt meter into a wall outlet.
5. Press the system's power button to start the system. Press the monitor's power button to turn on the monitor.
6. Once the desktop appears, click **Start**, and then, in the **Search/Run** field, type in **CMD**.
7. Right-click the **Command Prompt** application.
8. Click **Run as Administrator**.
9. Type **CMD.exe(space)/c(space)start(space)/wait(space)Rundll32.exe(space)advapi32.dll,(space)ProcessIdleTasks**.
10. Let the system run through all idle tasks. Do not disturb the system during this.
11. Once the command prompt appears, start a five-minute timer.
12. Once the timer is complete, start an hour timer.
13. At the end of the hour, record the kWh and time (duration).

Power load (without monitor)

1. Make sure that the user account's password is disabled and that the system is turned off before starting.
2. Plug the tower's power cord into a Kill A Watt meter.
3. Plug the Kill A Watt meter into a wall outlet.
4. Press the system's power button to start the system.
5. Once the desktop appears, double-click the SYSmark desktop icon.
6. Make sure that **Office Productivity**, **Media Creation**, and **Data/Financial Analysis** are selected.
7. Enter a **Project Name**.
8. Select **1** iteration, select the check boxes for **Conditioning Run** and **Process Idle Tasks**, and then click **Run Benchmark**.
9. Once the benchmark is complete, record the kWh and time (duration).

Power load (with monitor)

1. Make sure that the user account's password is disabled, the screen brightness on the monitor is set to the highest possible setting, and the system is turned off before starting.
2. Plug the tower's power cord and the monitor's power cord into a power strip.
3. Plug the power strip into a Kill A Watt meter.
4. Plug the Kill A Watt meter into a wall outlet.
5. Press the power button to start the system. Press the monitor's power button to turn on the monitor.
6. Once the desktop appears, double-click the SYSmark desktop icon.
7. Make sure that **Office Productivity**, **Media Creation**, and **Data/Financial Analysis** are selected.
8. Enter a **Project Name**.
9. Select **1** iteration, select the check boxes for **Conditioning Run** and **Process Idle Tasks**, and then click **Run Benchmark**.
10. Once the benchmark is complete, record the kWh and time (duration).

| Power Testing | Lenovo® ThinkCentre® M91p DH7 (legacy 3rd generation processor) | | | HP® EliteDesk® 800 G2 SFF with 4 GB RAM (6th generation processor) | | | Lenovo ThinkCentre M800Z All-in-One (6th generation processor) | | |
|------------------------|---|----------|------------|--|----------|------------|--|----------|------------|
| Test | Energy | Duration | Avg. Power | Energy | Duration | Avg. Power | Energy | Duration | Avg. Power |
| Without Monitor | | | | | | | | | |
| Idle | 0.02 kWh | 70 min | 17 W | 0.01 kWh | 73 min | 8 W | N/A | N/A | N/A |
| Load | 0.10 kWh | 178 min | 34 W | 0.04 kWh | 176 min | 14 W | N/A | N/A | N/A |
| With Monitor | | | | | | | | | |
| Idle | 0.05 kWh | 67 min | 45 W | 0.03 kWh | 73 min | 25 W | 0.05 kWh | 90 min | 33 W |
| Load | 0.18 kWh | 181 min | 60 W | 0.08 kWh | 159 min | 30 W | 0.11 kWh | 191 min | 35 W |

¹ Based on 2 minutes x 260 workdays per year. 2.65 wasted workdays based on 5 minutes x 260 workdays per year.

² This assumes 260 workdays per year.

³ \$45,378, assuming a weighted harmonic mean power savings of 9.92 W for a mix of 76 percent idle/16 percent load/8 percent off or asleep on desktop computers tested by Prowess (see Appendix B and source: California Energy Commission. "Computers Use More Energy Than Previously Thought." 2014. http://www.energy.ca.gov/releases/2014_releases/2014-10-28_computer_use_more_energy_nr.html.) and 8,766 hours per year at an average U.S. commercial electricity price of \$0.1036/kWh (see U.S. Energy Information Administration. "Average Price of Electricity to Ultimate Customers by End-Use Sector." January 2016. https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a).

⁴ \$57,734, assuming a weighted harmonic mean power savings of 13.27 W for a mix of 76 percent idle/16 percent load/8 percent off or asleep (see Appendix B and source: California Energy Commission. "Computers Use More Energy Than Previously Thought." 2014. http://www.energy.ca.gov/releases/2014_releases/2014-10-28_computer_use_more_energy_nr.html.) and 8,766 hours in a year for desktop computers tested by Prowess (see U.S. Energy Information Administration. "Average Price of Electricity to Ultimate Customers by End-Use Sector." January 2016. https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a).



The analysis in this document was done by Prowess Consulting and commissioned by Intel.

Results have been simulated and are provided for informational purposes only.

Any difference in system hardware or software design or configuration may affect actual performance.

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