The SSD-Enabled PC: Total Cost of Ownership Is Beyond Compelling

IN THIS WHITE PAPER

This IDC white paper reveals the benefits of replacing hard disk drives (HDDs) with the latest generation of solid state drives (SSDs) in PCs. While IDC reviewed this topic in 2011, we have revisited the discussion to ensure the analysis is timely and relevant. Although the baseline approach and methodology remain similar, the updated analysis takes into account some nuances with the evolution of the market:

- Corporate IT users have experience with SSDs in PCs.
- Managing IT is a more important cost factor than infrastructure.
- Costs associated with downtime and user productivity have risen.
- Concerns around security and the costs associated with data breaches are increasing.

The benefits of SSD-enabled PCs are discussed in the context of a formal total cost of ownership (TCO) analysis that compares metrics from organizations deploying HDD-based and SSD-based portable PCs. The metrics used in this analysis are associated with device performance, reliability, and usage environment, as well as normal IT labor costs incurred by companies using systems that leverage these storage technologies within the PC. The result is a model-based operational cost comparison of HDD-based and SSD-based PCs and the compelling reason to leverage SSD-enabled PCs.

METHODOLOGY

To develop a complete operational cost analysis, similar to the work completed in 2011, IDC identified several cost variables associated with the deployment, management, use, and support of corporate portable PCs. The metrics chosen are common to both HDDs and SSDs so that there are no inconsistencies within the TCO model.

The variables populated into the analysis are culled from IDC's Business Value database, which includes IT operational data from over 1,000 organizations. The comparable variables are based on the latest published specifications in some cases and vendor-supplied data resulting from controlled laboratory tests in other cases. Real-world specifications were gathered through published documents and a technology assessment that summarizes IDC's own experience using SSDs. IDC then modeled how these specifications would translate into the cost analysis.

PC operations are subject to a myriad of factors that influence costs, including usage environments, workloads, and IT practices and policies. Because of these factors, the actual operational costs may differ significantly from the costs calculated within this analysis. The goal of this analysis is to model the reduction in operational costs that an organization can expect to see when replacing HDDs with SSDs in portable PCs that are used in normal everyday work environments.

Note: All numbers in this document may not be exact due to rounding.

SITUATION OVERVIEW

SSDs have been used as a storage option for portable PCs for a number of years. Initially, owing to their high cost (relative to HDDs) and uncertain return on investment (ROI) for many users, SSDs were used primarily in very thin form factor portable PCs and/or in environments where a premium was placed on performance.

However, over the past several years, the steep decline of the cost of NAND flash has made high-performance SSD storage more economical for corporate portable PCs. Further, this trend of lower price per gigabyte ($/GB) is expected to continue over the next few years.

As a result, at popular SSD capacity points, the costs of these solutions are crossing and reaching the threshold of traditional HDDs (see Figure 1).
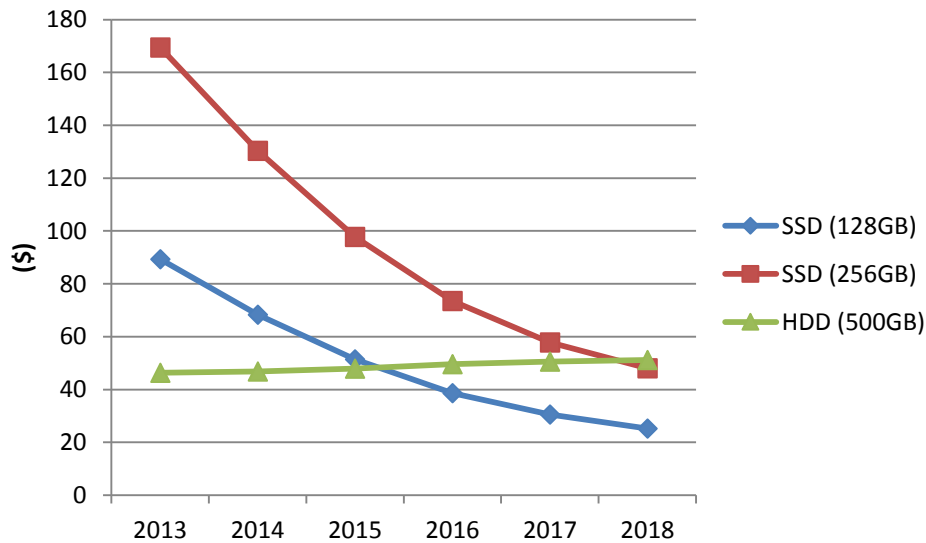
The lower costs of SSDs have made the use of the technology beyond compelling, given the modest capacity requirements of most corporate portable PC users, the accelerating use of cloud storage, and increasing security concerns, which limit the amount of capacity many organizations want employees to carry on their portable PCs.

As a result, today's corporate PC storage requirements continue to increase at very low rates, and this has allowed SSD vendors to meet acceptable capacity points at reasonable costs. Granted, where storage capacity is a top priority, HDDs will continue to have the advantage. Nevertheless, IDC finds that corporate PC capacity growth rates are stagnating as exemplified through the slowdown in the average capacity of installed base of HDDs being used in corporate portable PCs (see Figure 2).

Thus, thanks to the stagnating storage requirements across much of the corporate PC market, coupled with the fact the solid state storage capacity can now be acquired at reasonable price points, chief information officers (CIOs) have begun to transition their organizations away from HDD-based PCs to SSD-based PCs. This transition also enables CIOs to take advantage of the inherent benefits of solid state storage such as a more reliable platform that contains no moving parts and extend the lifetime of the platform while delivering better user experience as well as higher productivity for employees. Further, security is becoming a key requirement in most corporate environments given the numerous data breaches in the news recently. While software-based encryption can run slow on HDD-based PCs, self-encrypting drive (SED) SSDs provide corporate PC users with compelling additional benefits, such as better overall system performance, faster initial provisioning, and secure decommissioning of the device. In summary, there is a strong case for SSDs when considering the storage requirements of a corporate user.

FIGURE 1

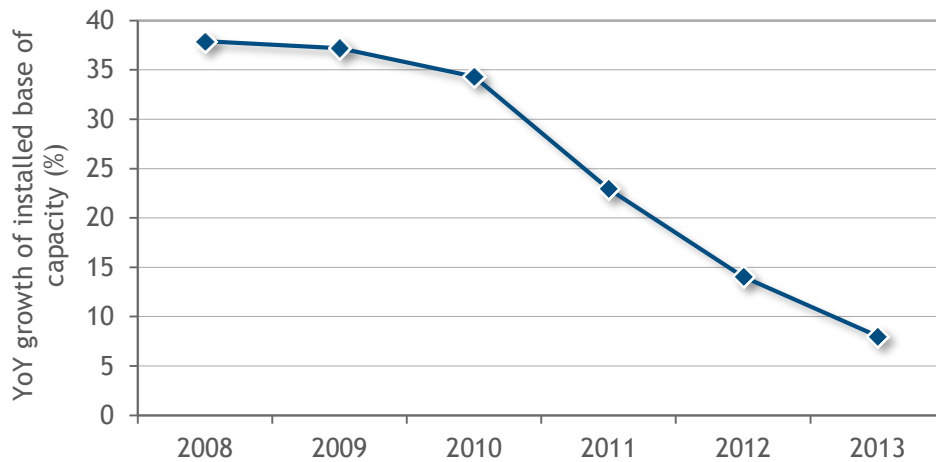## Worldwide Client SSD and HDD Average Selling Price, 2013-2018

Note: SSD and HDD capacity are not equivalent.

Source: IDC, 2014

FIGURE 2

Installed Base of HDD Capacity on Corporate Portable PCs, 2008-2013

Source: IDC, 2014

Defining the Cost Variables and Relationships

Total cost analysis evaluates the complete life cycle of the technology:

- **Acquisition.** The cost to acquire the portable PC (The acquisition cost is not considered in this analysis because it is a moving target, varies greatly among organizations, and will be demand driven. In IDC's opinion, the cost of any new technology, such as the SSD-based PC that is intended to replace legacy technology, should be a "result" of the cost-benefit analysis versus an "input." In other words, device suppliers and system OEMs should use TCO analysis to help determine the premium threshold users are willing to tolerate based on the expected TCO. Even so, the falling price per gigabyte of SSDs has enabled a lower acquisition cost of SSD-enabled PCs, and in many cases, the acquisition costs now fall well within the normal price range that many organizations expect to spend on a new portable PC.)

- **Deployment.** The IT labor costs to deploy PCs to users, including time to acquire, stage, migrate user data, distribute, and support for 30 days

- **Maintenance.** The cost to troubleshoot, repair, and maintain the device, including both IT labor costs and outsourced labor costs

- **Performance.** The costs associated with using the device (PC user productivity is a measure of user salary lost when users do not have access to applications due to boot/shutdown times and other related productivity variables, as well as lost time due to PC incidents or failures. In addition, power and extended battery life variables influence this part of the TCO model.)

- **Retirement.** The IT labor and hardware/software costs associated with replacing a device at the end of its life cycle (Generally, this is related to the refresh cycle of the device. Early replacement — or contrarily the lengthened refresh cycle — is a key variable within this cost bucket. Yet no single cost variable alone provides justification for substituting an SSD in exchange for an HDD in a portable PC. However, certain relationships among the variables can multiply the benefits [or detriments] associated with a given variable. Hence a formal model must be defined using the appropriate variables.)

Populating the Variables

HDDs have been around for multiple decades as an economical way to store and access digital content. Historically, HDDs have been used in and throughout the IT infrastructure and have significant roles in the entire digital universe. Much is known about the integrity and life of an HDD, and this industry knowledge is leveraged to populate the many variables within the model. SSDs have been around for many years, too, and have been used in military and industrial markets as an HDD alternative. Over the past few years, SSDs have matured and are used increasingly throughout the IT infrastructure. To complete the operational cost analysis, IDC leveraged vendor-supplied data to populate the correct fields within the model. In addition, real-world data was gathered through published documents and a technology assessment that summarizes IDC's own experience using SSDs.

KEY/COMPELLING FINDINGS

Breaking Down the Variables That Matter

The most impactful variables in this SSD TCO analysis revolve around the complete life cycle of the technology:

- **Maintenance and refresh cost** is the cost of an existing PC (or upgrading a PC with an SSD to reduce the cost of maintenance and refresh).
- **IT labor cost** is the cost to deploy PCs to users, including time to acquire, stage, migrate user data, distribute, and support.
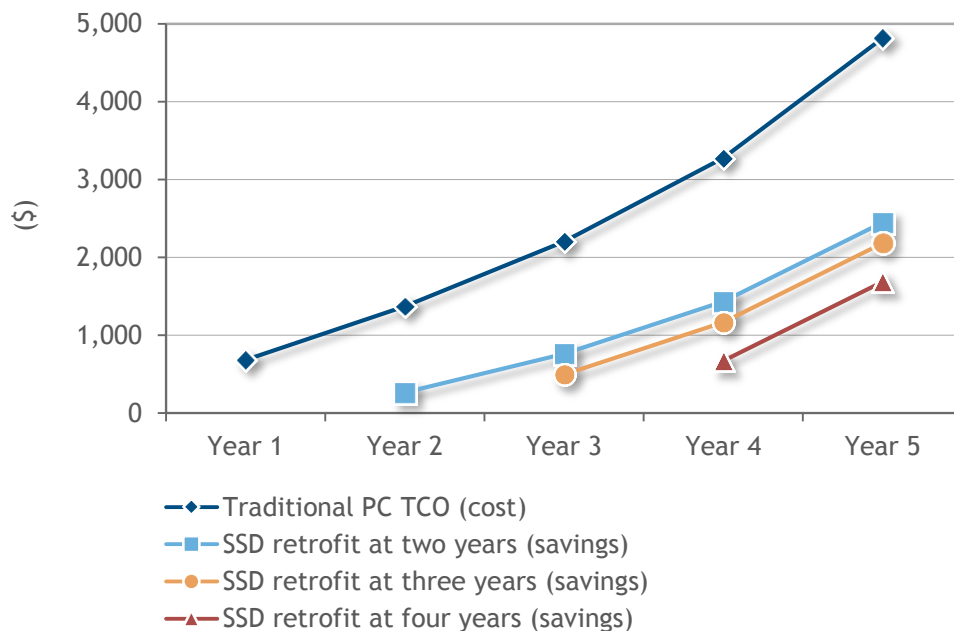- **User productivity cost** is the cost associated with user wait times and downtimes.

Hence a formal model must be defined using the appropriate variables and relationships to ascertain the most realistic cost-benefit picture.

Improving the Cost of Maintenance and Refresh

Over time, the performance of traditional HDDs slows, mainly because of the fragmentation of data that causes latency in finding and retrieving that data, leading to an increased chance of failure. This performance degradation is noticeable by users, thereby impeding their productivity and satisfaction. In many situations, replacing the HDD with an SSD not only improves performance but also reduces the cost to maintain and refresh the PC. Figure 3 illustrates the annual savings and cumulative savings when HDD is replaced with SSD.

FIGURE 3

Annual and Cumulative Savings per Existing PC with SSDs

Source: IDC, 2014

SSDs: A Robust Platform That Reduces Costs

IDC's analysis finds that organizations adopting the SSD platform will significantly reduce PC costs of ownership in two areas: more efficient IT staff operations associated with all phases of the PC life cycle and enhanced PC user productivity benefiting from higher PC performance and productivity. IDC research shows a total annual cost per PC for IT labor and user productivity of $1,113. By moving to SSD-based PCs, organizations are able to reduce annual costs to $771, a benefit of $342 in total, which includes a savings of $178 from IT labor cost reduction and a benefit of $164 associated with end-user performance and productivity improvements.
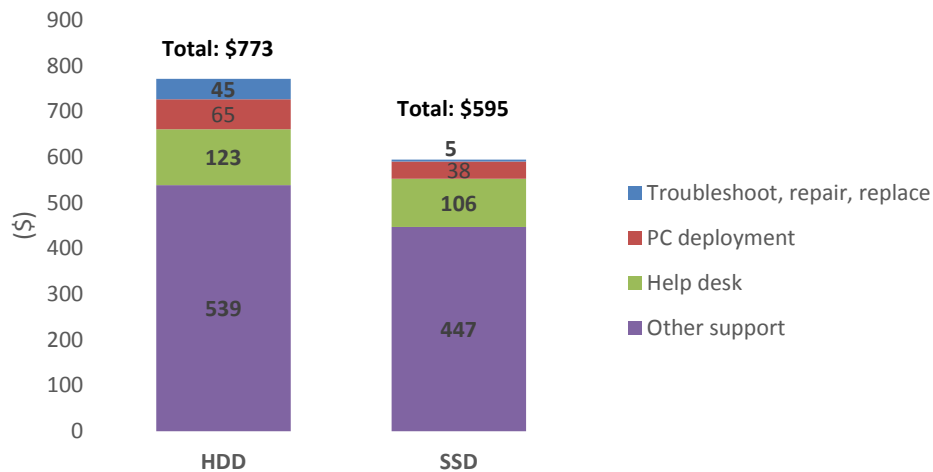
IT Labor Costs and Cost of Maintenance and Refresh

The cost for IT staff to maintain, repair, and replace is a key factor of the costs associated with corporate portable PCs (see Figure 4). A number of costs are associated with the support and maintenance of PCs, including troubleshooting, updating, repairing, replacing, deploying new PCs, help desk support, and other support. IDC calculates a total annual IT labor cost of $773 to support each HDD-based PC. This total cost for IT labor is reduced by 23%, or a total of $178, with SSD-based PCs. Based on IDC data, the benefits clearly favor SSD-based PCs and result in the following cost reductions:

- Reduces annual IT labor costs to evaluate, fix, and repair crashed or improperly working existing drives and recover lost data by 90% as well as provide annual support to PCs and PC users (software upgrades, patching, etc.) by 17% ($133 per user per year)
- Reduces new PC deployment costs by 43% ($28 per user per year)
- Reduces first-level help desk support costs by 14% ($17 per user per year)

FIGURE 4

Annual IT Labor Costs per PC

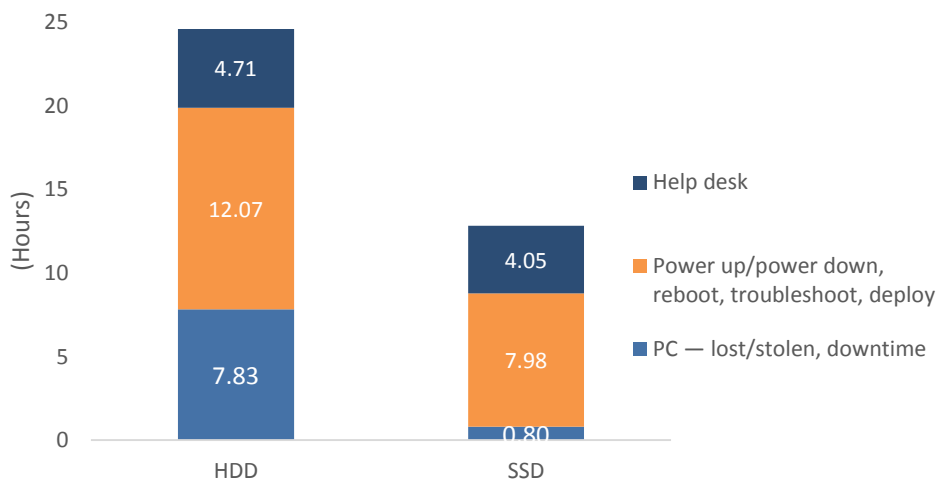Source: IDC, 2014

User Productivity

PCs outfitted with SSDs provide users higher productivity because of the increased reliability, higher performance, and lower power consumption when relying on battery power. The published reliability improvement in terms of mean time between failure (MTBF) of SSDs over HDDs is higher, increasing productivity by reducing PC user productive time lost as a result of the unplanned outage and the time required for repairs and replacement. In addition to failure, downtime can be caused by performance issues. By utilizing solid state memory, SSDs can provide increased performance on a daily basis by offering quicker application launches and faster data transfers or access. The total annual benefit to PC user productivity is $164 per user.

Our model suggests the following benefits of using SSDs to increase user productive time (see Figure 5):

- User productive time is increased by improving PC performance and accelerating user access to applications and overall PC functionality by 34% and giving each user four to five hours of additional usage time each year.
- By reducing unplanned downtime 90%, SSD-based PCs enable roughly 8-10 hours of more productive time to each PC user annually.
- Other productivity improvements related to wait times for help desk or the deployment of a new PC equate to savings of another one to two hours per PC user (a 14% improvement).

FIGURE 5

Annual User Productivity Costs per PC (Productive Hours Lost per User)

Source: IDC, 2014
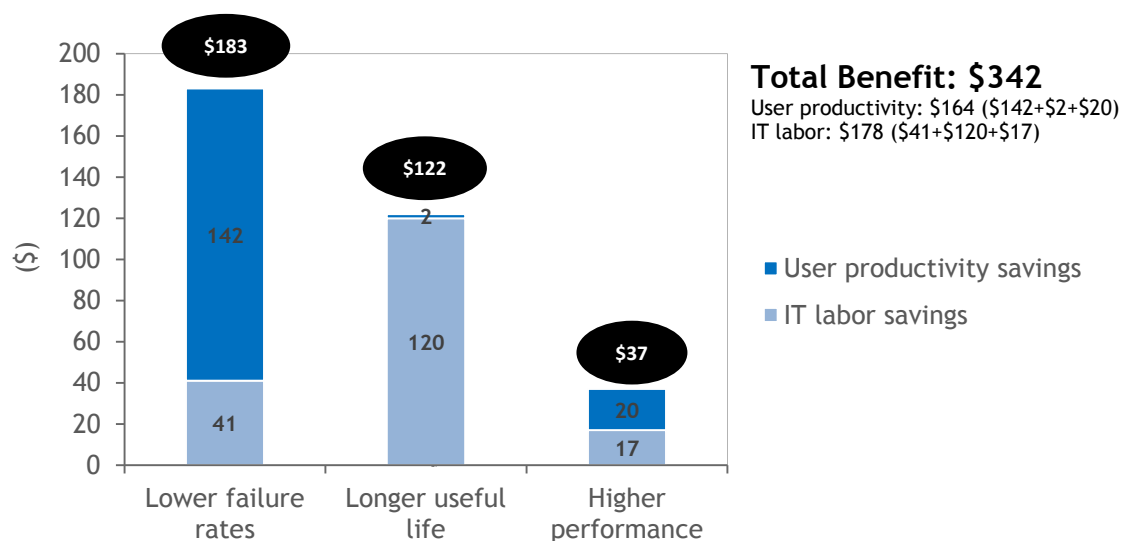
TOTAL COST BENEFITS AND POTENTIAL ROI

The increased performance, reliability, and power savings inherent in SSDs translate to a compelling positive cost benefit for each PC user. Adding all these cost benefits together results in a calculated annual savings of up to $342 per user (see Figure 6).

If we revisit the total cost benefits from the migration to SSD-based PCs ($342 per user), including user productivity savings ($164) and IT labor savings ($178) benefits, it is useful to understand the characteristics of SSDs that drive these benefits:

- **Lower failure rates.** IDC's analysis shows the greatest benefit in migrating to SSD-based portable PCs is the savings related to lower failure rates. The savings comes from lower IT labor costs for PC repair/replacement ($41 per user) and reduction in user troubleshooting and downtime ($142 per user), resulting in an annual benefit of $183 per user.

- **Lower maintenance and refresh cost.** PCs with HDDs suffer significant drop-offs in performance and reliability at around three years after being deployed, which forces organizations to evaluate trade-offs between more frequent PC refreshes and incurring higher annual PC support costs. With a 20-40% longer useful operating life, PCs with SSDs require less annual support and maintenance, and users enjoy longer periods between PC replacements. IT labor costs for annual support are reduced after three years ($92 per user annualized). Extending refresh cycles of new PCs can provide annualized savings of $28 in IT labor and $2 in lost user productivity, with total annual average benefit of $122 per user.

- **Higher performance.** Performance improvements are largely driven by daily shortened power up/power down and reboot events and less frequent calls to the help desk for performance issues; such improvements add six to seven hours per PC user each year in increased productivity and reduce help desk IT staffing costs. In total, performance improvements drive combined IT labor and user productivity benefits of $37 annually per user.

FIGURE 6

Annual Savings per PC with an SSD

Total Benefit: $342
User productivity: $164 ($142+$2+$20)
IT labor: $178 ($41+$120+$17)

■ User productivity savings
■ IT labor savings

Source: IDC, 2014

CHALLENGES/OPPORTUNITIES

The PC market is an industry that continues to evolve with new form factors, ultrathin PCs, 2-in-1s, and tablets, as well as price points (e.g., sub-$200 PCs). These developments are altering long-term industry dynamics and challenge both corporate buyers and consumers in terms of which client device to purchase next. The growth of the cloud and cloud storage options is another factor that is affecting the industry as well as local storage requirements, further adding to the complexities.

NAND flash storage has already become the de facto standard in many embedded and consumer electronics solutions (i.e., mobile phones and tablets). While adoption in the PC market continues to expand, today, SSD-based PCs are still in the minority in both the portable environment and the desktop environment because most users continue to use legacy HDD-based PCs. For example, less than 10% of worldwide new PCs (both desktop and portable) in 2013 shipped with an SSD.

On paper, the benefits of SSD-based portable PCs seem obvious; however, in reality, a number of challenges to SSD-based portable PC adoption must be addressed:

- **Cost concerns to fit within the end user's budget.** There is no question that there is a premium associated with the price of an SSD compared with an HDD for the same capacity point. Cost is a function of capacity and the budget for storage within the device's bill of materials.

- **Capacity requirements.** SSDs lag behind HDDs when measured on a cost-per-capacity basis. The key, however, is that there is an acceptable amount of capacity to ensure a positive end-user experience in an SSD-enabled PC (such as 128GB). While further declines are expected in the average selling price of a PC (which will ultimately pressure the amount of storage capacity), IDC research suggests that storage capacity requirements have stagnated and that many corporate PC buyers may be satisfied with a lower capacity point than is currently available from HDDs (such as SSDs of 128GB or 256GB).

- **Overcoming misconceptions about the technology.** While SSDs have matured over the past few years, the technology is fundamentally new. SSDs and HDDs are primarily different storage devices, and many IT managers have a long history with HDDs. Whether it's measuring SSD performance or reliability, the industry is evolving around specifications, such as JEDEC, to make it easier for organizations to compare drives and to help them choose the best products for their needs.

CONCLUSION

SSDs have a very compelling TCO benefit for corporate PC users, and the benefit continues to improve as a result of the lower cost (i.e., price per gigabyte is falling) of SSD-based storage. This not only facilitates the transition to more SSD-based PCs because of lower acquisition cost for many organizations but also enables CIOs to more easily justify the use of SSDs, thanks to the expected savings over the life of the PC. At first glance, it may appear that SSDs are a more expensive storage solution than traditional HDDs. However, based on IDC's TCO analysis, the increased performance, reliability, and power savings inherent in SSDs translate to annual savings of up to $342 per user.

Taking a step further, organizations may find additional benefits of SSD-based PCs beyond this TCO savings. Security is becoming a key requirement in most corporate environments. Organizations should consider SED SSDs, as SSDs not only provide significant TCO savings over HDDs but also protect companies from data breaches stemming from lost or stolen laptops. The average data breach settlement can cost companies millions of dollars. Protecting corporate IP and preventing data breaches are essential

when planning for the future. Furthermore, software-based encryption can run slow on HDD-based PCs, while SED SSDs provide compelling additional productivity and use case benefits for corporate PC users.

Finally, many organizations are looking for ways to maximize the investment in existing PCs. IDC research suggests that replacing an HDD with an SSD not only improves performance but also reduces the cost to maintain and refresh PCs in many situations. These cost improvements of a corporate PC provide a number of benefits, including productivity improvement, lower IT labor costs and, ultimately, a lower TCO over the usable life of the PC.

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