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Enterprise Class SSD:
A Business Benefit Analysis

A J.Gold Associates Research Report

"Intel® Corporation recently announced a new enterprise-class Solid State Drive for mobile devices with improved performance, advanced hardware assisted encryption, and enhanced remote management capability... Many organizations wonder if this is something that companies should implement across all platforms despite a cost premium... We are confident that organizations that deploy solid state drives will achieve a substantial positive benefit…"

J.Gold
Associates

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Introduction

Intel® Corporation recently announced a new enterprise-class Solid State Drive with improved performance, advanced hardware assisted encryption, and enhanced remote management capability that is optimized for Intel vPro™ Technology. Many organizations wonder if deploying solid state drives is something that they should implement across all platforms despite a cost premium over more traditional hard disk drives. We have analyzed the benefits enterprises can achieve by converting to solid state drives and we believe the answer is yes. Below we identity and quantify our analysis and its results. We are confident that organizations that deploy solid state drives will achieve a substantial positive benefit, and recommend that all organizations implement this strategy as soon as possible, especially for new device purchases and machine refresh. While we expect any computing device to benefit from solid state drives, the greatest benefits are likely to occur in mobile devices.

> *TREND: In the next 1-2 years, we expect the majority of enterprise notebook PCs to be powered by solid state drives (SSD). Compared to hard disk drives they have a small cost premium but enable significant productivity improvement due to higher performance and a much lower failure rate. A compelling ROI makes SSDs an easy choice in most business settings. Companies should include SSDs in all new device purchases and/or updates.*
> *J.Gold Associates LLC.*

Things to Consider in Mobile Storage

The majority of companies select a notebook computer without really thinking about the optimal choice for storage. In reality, the selected storage component can have substantial impact on the machine's performance, level of security and cost of ownership. Many enterprises are hesitant to pay a premium price for a machine with an improved capability. Our research indicates that the selection of a Solid State Drive (SSD) can reduce cost of operations and provide a large return on investment despite the small additional acquisition cost of the SSD enabled machines over ones equipped with a standard hard disk drive (HDD). In determining the best storage option for mobile devices, we recommend that organizations evaluate the following four critical areas: cost benefits of lower failure rates, productivity improvement savings, mitigation of potential costs of data security breaches, and remote management capabilities to reduce TCO. In the following sections of this research report we provide a cost benefit analysis of each area.

Assessing the Cost Benefits of SSD's Lower Failure Rates

SSDs generally have far fewer "crashes" than do HDDs. But is there a significant cost benefit to organizations in deploying machines with SSDs given the cost premium associated with them? From our research, we created a model from which we calculated the total cost advantage contributed to machine failures for SSD vs. HDD for both a 3 year deployment lifecycle and a 5 year deployment lifecycle, and for both a 1 year warranty and extended 3 year warranty period. The results are provided in Figure 1.

Figure 1: SSD Cost advantage due to reduced failures rates*

Cost Advantage of SSD	Savings
• 3 year lifecycle with 3 year warranty • 3 year lifecycle with 1 year warranty • 5 year lifecycle with 3 year warranty • 5 year lifecycle with 1 year warranty	• $195.58 • $213.95 • $474.45 • $492.82

Further, we calculated the return on investment (ROI) of the extra acquisition cost of an SSD vs. HDD for both a 3 year deployment lifecycle and a 5 year deployment lifecycle, and for both a 1 year warranty and extended 3 year warranty period. The results are provided in Figure 2.

Figure 2: Return on Investment of SSD*

Return on Investment of SSD	ROI
• 3 year lifecycle with 3 year warranty • 3 year lifecycle with 1 year warranty • 5 year lifecycle with 3 year warranty • 5 year lifecycle with 1 year warranty	• 98% • 107% • 237% • 246%

From the above results, it's clear that SSDs offer a substantial positive return, despite the increased acquisition cost. SSDs should be an easy choice for most organizations.
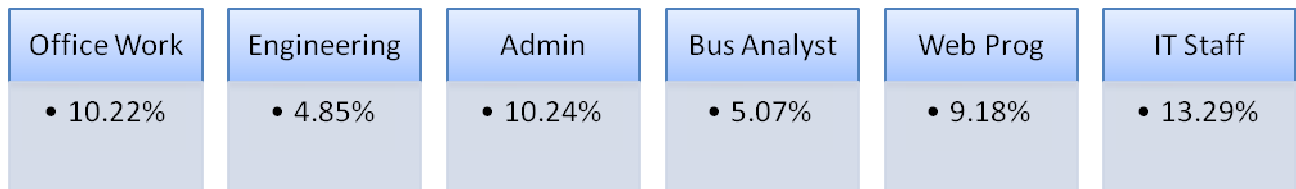
*Above results excerpted from: "Solid State Drives in Notebooks: Cost Advantage or Cost Liability?", A J.Gold Associates Research Report Copyright July 2009. All rights reserved.

The Productivity Advantage of SSD Equipped Machines

SSDs generally offer a significant improvement in access speeds compared to HDDs. But is this improvement reflected in real world system scenarios, and what is the overall value of this advantage when it comes to user productivity? To examine this issue, we tested two identical notebooks – one outfitted with an SSD and one with an HDD. We benchmarked the machines against scenarios that included a specific set of tasks weighted towards six typical roles within a corporate workforce. The weighted tasks were used to compute a productivity improvement value for each role. The results of the calculations for the determined roles are presented below:

Figure 3: Average weighted worker role productivity improvement using SSD*

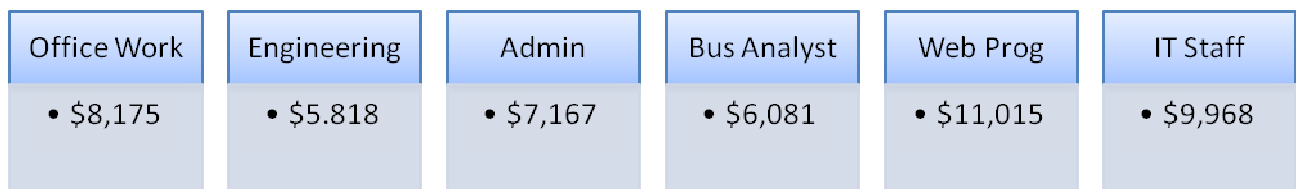| Office Work	Engineering	Admin	Bus Analyst	Web Prog	IT Staff
• 10.22%	• 4.85%	• 10.24%	• 5.07%	• 9.18%	• 13.29%

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The results show a significant productivity improvement across the various roles. Even the lowest improvement at approximately 5% is still a significant productivity enhancement, while the highest at approximately 13% indicates a substantial return on investment potential.

Using the above results, we determined an actual dollar amount for each role by creating a representative "fully burdened" cost for each worker type. From the salary and percentage of productivity improvement determined, we calculated the amount of productivity improvement savings per employee. As expected, this amount varies by employee type based on percentage improvement and total compensation, but is nevertheless quite significant, ranging from $5,818 to $11,015 per year.

Figure 4: Average yearly productivity improvement savings*

Office Work	Engineering	Admin	Bus Analyst	Web Prog	IT Staff
• $8,175	• $5.818	• $7,167	• $6,081	• $11,015	• $9,968

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It is important to note that these numbers are per user per year. The average PC remains in service for 3-4 years, so the actual return on investment for deploying an SSD vs. an HDD for each worker type is 3-4 times the amount indicated above. The calculation below assumes the shorter 3 year lifecycle for a machine. Organizations deploying SSD enabled machines for longer will find an increased ROI related to the length of service of the device.

Figure 5: Total productivity improvement savings over 3 year machine life*

Office Work	Engineering	Admin	Bus Analyst	Web Prog	IT Staff
• $24,524	• $17,453	• $21,500	• $18,242	• $33,044	• $29,904

Many organizations include a Return on Investment (ROI) calculation as part of their planning process, as well as using it to determine whether a particular expenditure is worthwhile. To that end, we have calculated the ROI for a 1 year and 3 year lifecycle.

Figure 6: 1 Year and 3 Year Return on Investment*

Office Work	Engineering	Admin	Bus Analyst	Web Prog	IT Staff
• 2477%	• 1763%	• 2172%	• 1843%	• 3338%	• 3021%
• 7432%	• 5289%	• 6515%	• 5528%	• 10013%	• 9062%

The above calculations represent the 1 year and 3 year ROI based solely on the productivity improvements per worker type obtained by deploying an SSD-enabled vs. an HDD-enabled machine. From these results it is clear that the substantial improvements when deploying SSDs over conventional HDDs make it a simple way for any organization to increase the productivity of its workforce and generate attractive return on investment. The SSD acquisition cost premium is insignificant compared to the productivity benefits obtained.

Achieving Payback: The large productivity gains provided by SSD-enabled machines means that companies will recover the cost premium for SSDs in as little as 7-14 work days.
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*Above results excerpted from "Investing in Solid State Drives Offers Significant Cost Advantage", A J.Gold Associates Research Report Copyright October 2012. All rights reserved.

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Mitigating the Cost of Security Breaches for Mobile Devices

Mobile devices exhibit a unique risk to organizations. The large amount of sensitive data being carried coupled with the relative ease of being lost or stolen can put organizations at greater risk of noncompliance with the increasingly stringent regulations regarding personal data loss. Indeed, most companies do an inadequate job of fully protecting the data contained on their mobile devices. Any loss of data can result in massive mitigation costs, customer defections and overall business loss.

It may not be possible to fully determine risk of data loss for each organization and user, as each company and industry has a different risk profile. But using industry metrics and our own research, we have calculated statistics that are useful for planning purposes.

Our research indicates that less than 35% of enterprise notebooks have data secured by disk encryption. That means that 65% of lost devices will have data available "in the open" to anyone able to log onto the device, or able to copy files by bypassing the operating environment (e.g., booting the machine with a Linux CD/USB which then bypasses the login security and makes on-board files accessible). Our research also indicates that on average across all business types approximately 3%-5% of corporate notebooks are lost or stolen each year, but we found that in certain industries, the loss ratio can be much

> *Research: On average, 3%-5% of notebooks are lost or stolen representing 150-300 lost devices per year in a 5K user company. Some industries reach 10%-15%. Only 35% of machines have encryption enabled to secure the data.*
> *J.Gold Associates LLC.*

higher. Some education and healthcare institutions have indicated as high as 10%-15% loss of mobile devices, and it's not uncommon for some technical services organizations to exceed that level when they ultimately do a complete audit of their devices. Certain industries, like financial services with tighter audit controls, tend to have a below average loss ratio of 1%-3%. What the above reveals is that internal controls across organizations and industries vary widely and have a significant effect on loses.

In an organization with 5K machines deployed to users, the conservative 3%-5% loss figure represents 150 – 300 notebooks per year. We estimate that less than 10% are ever recovered (in some organizations we've observed this figure is close to zero). The loss of hardware represents lost assets, but the greater impact is the cost of the lost sensitive data which has the potential to be many orders of magnitude larger.

While it's not always possible to determine the amount of sensitive data on each machine, it is possible to estimate what lost data costs an organization. Ponemon Institute, which has done multiple studies on lost devices, indicates that each personally identifiable record lost on a mobile device has a mitigation cost of approximately $208*. Therefore, a lost machine with 10K records (a modest number given the large databases deployed on many devices) would cost $2.08M to mitigate. Even a single lost device can therefore have extremely significant negative consequences.

* 2011 Cost of Data Breach Study: United States, Ponemon Institute March 2012

Further, Ponemon found that on average, a lost laptop costs an enterprise $49K*, and that 80% of that cost was associated with the lost data. The device replacement cost generally represents less than 2% of this amount.

The Billion Dollar Lost Laptop Problem, Benchmark Study of US Organizations, Ponemon Institute 2010

The Cost of Lost Data

Figure 7 indicates the average cost per user for losses resulting from unencrypted devices due to a security breach. We modeled an organization with 5K machines as the baseline and allocated the total cost across each device in the installed base. Many organizations will find their actual cost much higher, depending on the industry and how highly regulated it is (e.g., financial industries, health care).

Figure 7: Mobile Lost Device Cost per Machine for 5K Installed Base

% Lost	# Machines	Total Cost	Cost per Machine	3 Year Total
• 3%	• 150	• $7.35M	• $1470	• $4410
• 5%	• 300	• $14.7M	• $2940	• $8820

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Clearly the cost of $1470-$2940 per device per year is significant and organizations must do all they can to mitigate these costs. It is imperative that organizations utilize encryption as further protection against data breaches. In the past, many organizations have not enforced this policy due to a negative performance impact that made the user experience unacceptable. However with the advent of hardware assisted encryption on current generation enterprise-class SSDs, user experienced performance problems are a thing of the past. Companies should deploy machines with SSDs that include HW enabled encryption as a first line defense against costly corporate data breaches and regulatory non-compliance consequences.
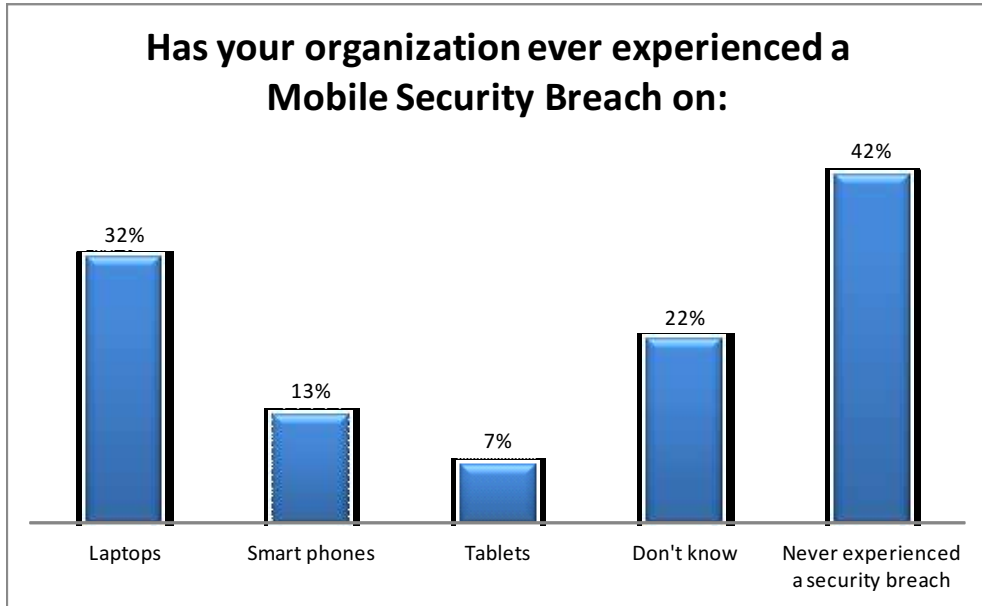
Data Loss without Machine Loss

While lost and/or stolen machines represent a real liability, it is not the only way corporate data can be compromised. Breaches can occur even if the device is not lost. In a recent survey*, we asked 270 enterprises a number of questions regarding their mobile strategies. To better understand the level of data breaches occurring on mobile devices, we inquired about how many have had a mobile security breach and on which type of device. We then segmented the overall responses by vertical industry. Figure 8 represents the average response across all industries, while figure 9 shows the response specific to several industries.

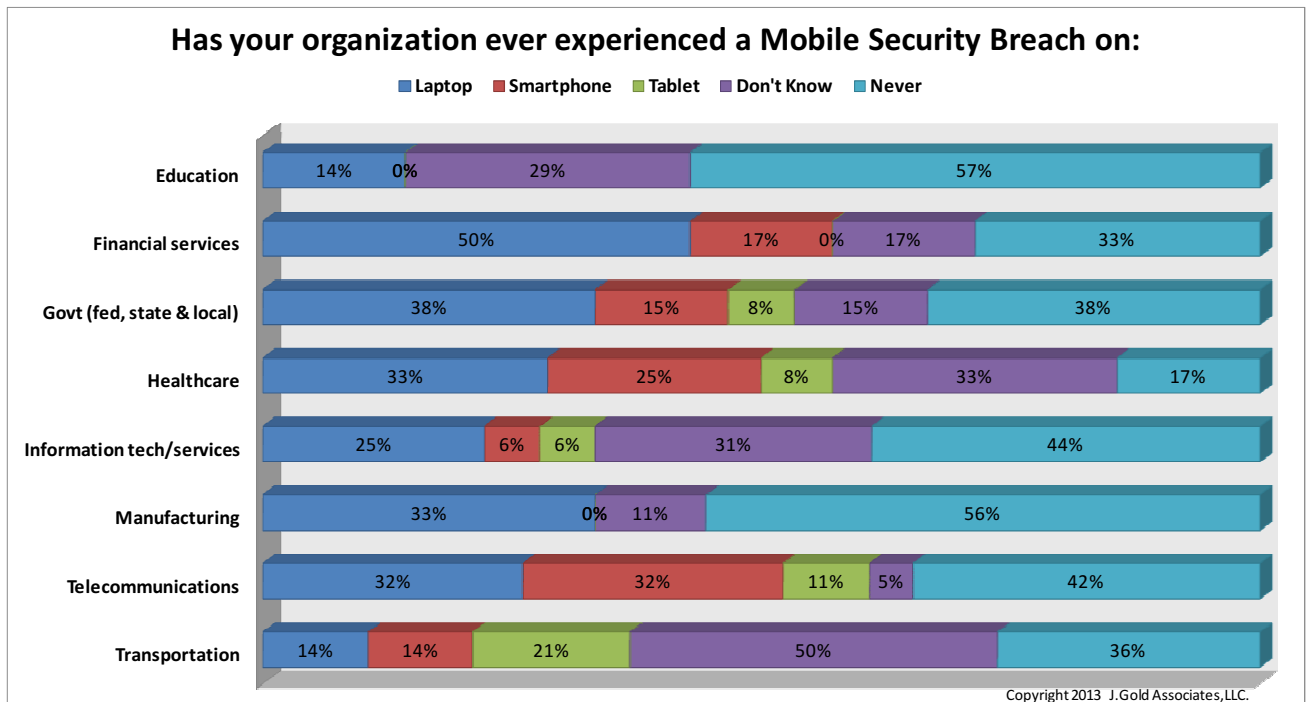*"The Mobile Enterprise: A Study of Strategies and Trends", Copyright 2012, J.Gold Associates, LLC.*

Figure 8: Mobile Data Breach by device type

**Has your organization ever experienced a
Mobile Security Breach on:**

- Laptops: 32%
- Smart phones: 13%
- Tablets: 7%
- Don't know: 22%
- Never experienced a security breach: 42%

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Figure 9: Mobile Data Breach by Industry

Has your organization ever experienced a Mobile Security Breach on:

Legend: ■ Laptop ■ Smartphone ■ Tablet ■ Don't Know ■ Never

Industry	Laptop	Smartphone	Tablet	Don't Know	Never
Education	14%	0%		29%	57%
Financial services	50%	17%	0%	17%	33%
Govt (fed, state & local)	38%	15%	8%	15%	38%
Healthcare	33%	25%	8%	33%	17%
Information tech/services	25%	6%	6%	31%	44%
Manufacturing	33%	0%		11%	56%
Telecommunications	32%	32%	11%	5%	42%
Transportation	14%	14%	21%	50%	36%

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What's troubling about this data is that so many organizations believe they have never experiences any data loss. Further troubling is that many organizations don't know whether they have ever experienced a data breach. It is highly likely that a large portion of the "don't know" and "never" respondents have indeed had a data loss but have no way of knowing it. This lack of information on losses should be a compelling reason to take all appropriate steps to secure organizational data against loss. With 64% of respondents saying they don't know or have never had a data breach, its incumbent on organizations to do a self assessment, and to take all preventative measures necessary, starting with encryption of all data present on each corporate device.

BYOD and the Security Conundrum

With the rapid growth of Bring Your Own Device policies in many enterprises, it's even harder for companies to ascertain whether their data is fully protected. We believe that no enterprise should allow a computing platform onto its network to access its corporate data without meeting a minimum level of compliance to corporate security policy. Any user bringing a device into the organization should be required to have a high level of encryption for all data stored on the device, and that the company should be allowed to set and enforce policies that guarantee this. Enterprises have a right to require users to deploy devices with enhanced hardware assisted encryption and mobile management/policy enforcement capabilities such as available on next generation SSDs. Failure to do so will subject the organization to potentially huge losses and regulatory compliance prosecutions.

Minimizing TCO: Reloads and Reimaging via Remote Control

It is a fairly common practice for IT departments to reimage drives on notebooks. This can be caused by an OS failure, an end user error, or simply the aging process as more SW is added and performance of the machine declines. For many organizations this is a manual process requiring the user to deliver the machine to IT for some period of time, resulting in a reduction in user productivity and increased cost of operations.

Our research indicates that the cost differential between a manually reimaged machine and one that is done through a remotely automated process is $272. Further, we estimate that the average corporate machine will be reimaged at least once per year. Over a three year lifecycle of a typical machine, the cost differential is $815.

Figure 10: Cost savings for remotely managed re-imaging of drive
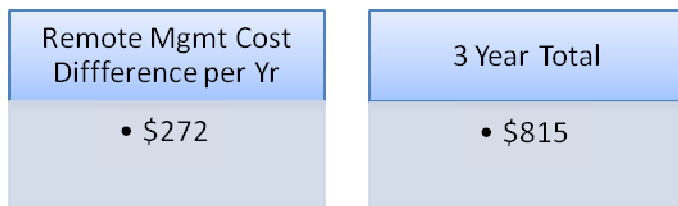
Remote Mgmt Cost Diffference per Yr	3 Year Total
• $272	• $815

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Remote Monitoring/Health

One feature set that any enterprise level drive should include is the ability to remotely monitor its own health. Autonomously providing alerts to potential failures and/or operational problems allows an organization to deploy devices that while not fail proof, at least can be monitored and alert to any issues before a surprise total failure occurs so corrective action can be taken. For example, with proper algorithms built into its control circuits, the drive can determine how to compensate for bad data blocks, or that an inordinate number of read/write operations are failing indicating a potential total failure or that only 20% of the useful life is left and drive life is coming to an end. While HDD devices have some capabilities, SSDs by their very nature have more capabilities to monitor and act upon potential failures. Companion toolsets connected into corporate management consoles can provide an advantage to minimizing field failures, user inconvenience and lost data. Such value added software should be a must for any enterprise class SSD being deployed.

Capacity Tradeoffs

Some organizations have concluded that HDDs are a better fit due to the larger capacity available at a lower cost. While the "sweet spot" in most HDD-enabled systems is 500GB-1TB, the SSD "sweet spot" has been rising lately from the previous average of 128GB and is currently in the 200GB-250GB area. We expect it to reach 500GB in 2-3 years. Our research indicates that for most enterprise users, the capacity of an SSD is more than adequate to operate all of the corporate applications and data systems for all but the most extreme

> *Research: SSD "sweet spot" capacities have been rising recently from the previous 128GB to the 200GB-250GB range, and to 500GB in 2-3 years, providing ample storage for most enterprise users.*
> *J.Gold Associates LLC.*

users. Indeed, having the smaller capacity can be advantageous in keeping large amounts of personal data off the machine, requiring less IT overhead for backups and management. We believe the size of the average SSD is not a negative factor for the majority of enterprise users, and organizations should not use that as an excuse to forego the substantial cost, performance and security benefits they provide.

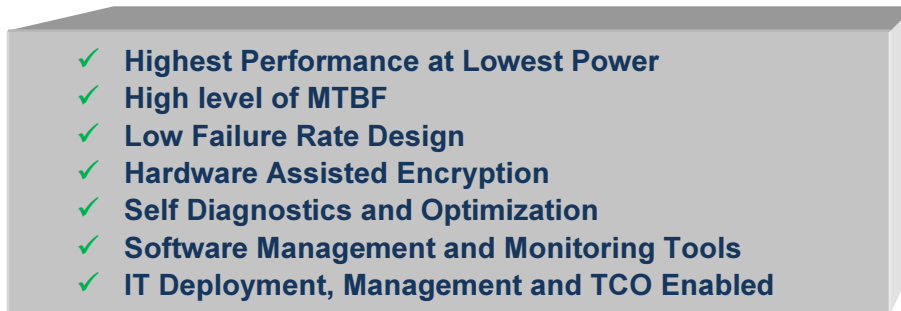## Enterprise-Grade SSD Selection

It's important to note that not all SSDs are created equal. Many have been optimized for the lowest cost and targeted at consumer devices. We recommend that organizations deploying SSD enabled machines specify an enterprise-grade device. The relatively small additional cost (10%-20%) will be more than recovered through better performance, reliability and manageability of the higher quality SSD. Hardware assisted security is key to maintaining a secure enterprise. And not all SSDs are designed for reliability and lowest failure rates when used in the more intense operations of the enterprise user. Further, enabling management capability through products like Intel vPro™ adds functionality and reduces TCO while being compatible with existing infrastructure solutions.

We recommend that companies look at the following selection criteria in evaluating the suitability of an enterprise-grade SSD and not simply buy the lowest price consumer oriented product offering.

Figure 11: Enterprise-Grade SSD Evaluation Criteria

✓ **Highest Performance at Lowest Power**
✓ **High level of MTBF**
✓ **Low Failure Rate Design**
✓ **Hardware Assisted Encryption**
✓ **Self Diagnostics and Optimization**
✓ **Software Management and Monitoring Tools**
✓ **IT Deployment, Management and TCO Enabled**

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Recommendations

We strongly recommend that all enterprises acquire and operate mobile machines with enterprise-class SSD drives. They offer a major benefit to organizations in both real return on investment and in increased user satisfaction. They exhibit increased levels of reliability, performance, security and manageability. Companies should not be alarmed at the small price premium for SSD over HDD equipped machines, nor the slight price premium for enterprise-grade SSDs over the lower cost consumer-oriented SSD devices. This is quickly recovered as our cost models above have shown. Organizations that deploy SSD devices benefit from reduced failure rates, higher end user productivity, fewer data security breaches, and lower overall total cost of ownership through automated management features. Virtually all organizations can benefit from SSD deployments, and they should not hesitate to do so as soon and as widely as possible.

Resources:
For more information about Intel Enterprise Class SSDs including a TCO modeling tool, visit
http://www.intel.com/go/ssd

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J.Gold Associates provides insightful, meaningful and actionable analysis of trends and opportunities in the computer and technology industries. We offer a broad based knowledge of the technology landscape, and bring that expertise to bear in our work. J.Gold Associates provides strategic consulting, syndicated research and advisory services, and in-context analysis to help its clients make important technology choices and to enable improved product deployment decisions and go to market strategies.